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Editors:
CHARLES W. PRICE. A. A. GRAY. F. H. BERNHARD.
Associate Editors:
H. FARRINGTON. H. EHRLICH. C. H. SEAVER.

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MINIMUM CHARGE DECISIONS BY THE MASSACHUSETTS COMMISSION.

An important decision respecting the minimum monthly meter charge of the Edison Electric Illuminating Company of Boston has been handed down by the Massachusetts Gas and Electric Light Commissioners, acting under an appeal of Joseph J. Leonard and others, and following several hearings on the matter which developed considerable information of technical interest. The petitioners are customers of this company, with offices scattered through one of the larger buildings of the city, and they claimed that the minimum meter charge of $1.00 per month per meter is excessive, and should be reduced or abolished. The petitioners conceded during the hearings, however, that some, though lesser, minimum charge was reasonable.

The Commissioners state that the charge is, strictly speaking, one imposed upon all customers whose actual consumption falls below a certain amount. It appears to be as much for the purpose of raising revenue as the price per kilowatt-hour in force for energy consumed. As a revenue producer, however, the minimum monthly charge is almost a negligible factor. In the case of the Boston company, the receipts from this charge in 1908 were only $20,000 out of $4,000,000 total revenue.

Regarding the company's arguments, the Board summarizes them under two headings, first, that the minimum charge was essential to return the actual expense due to the maintenance of a meter, and second, that it saves the company from a costly and substantial increase in dead investment. The company figured that the annual expense of maintaining a meter for a customer paying a minimum monthly charge was $7.25, to which should be added forty kilowatt-hours at the prevailing maximum net rate, or $4.80 worth of energy per year, making the total cost of meter maintenance, including fixed charges, testing, repairs, reading, depreciation and loss of lamps, accounting and billing, postage and stationery, $12.05 per annum. This consumption of forty kilowatt-hours per year arises from the excitation of the shunt coil of the meter so long as the instrument is connected to the company's lines, and the company argued that it was fair to charge for this, not the cost of the energy at the busbar of the generating station, or even at the consumer's terminals, but the revenue which the company might have derived from its sale, since all current which was thus diverted to excite the meter field was then and

there forever lost as a source of income to the system. The Commissioners emphasize, however, the great difficulty of accurately determining the average expense of maintaining a meter on the premises of a consumer who uses little electricity, quite apart from the possibility of getting an average figure for the maintenance of the meters on the system as a whole.

The Board says, in regard to the effect of the minimum charge in preventing the accumulation of dead investment, that there is a real and important purpose of the charge. Nevertheless, it holds that the company is bound to supply even small and occasional users without imposing a minimum charge unreasonable and prohibitive in amount. The Commissioners regard the minimum charge, especially on a large and well-established central-station system, as of more consequence to the general body of the consumers than to the company itself; for, if there should be a too rapid growth of a company's business where under present conditions no substantial demand exists, the promotion of electrical applications and use may be hampered. Respecting the present charge the Board states that no increase in the amount should be allowed, and that a smaller amount might be desirable. Whatever hardship arises comes mainly because the charge is imposed in certain months without regard to the fact that the same customer may use considerable electricity in other months and throughout the year on an average of more than the monthly minimum.

Again, the Commission points out that there has been a law on the Massachusetts statute books for about twenty years permitting the imposition of a minimum charge of $7.00 per year for a gas meter. The law states that "no charge for the use of a meter during any portion of any twelve consecutive months shall be made if the consumer during said time uses gas to the value of seven dollars." There has been no serious demand for the repeal or modification of this law since its enactment.

The Commissioners show that the reasons for permitting a charge in the gas business have even greater force in electrical supply. Certain elements of cost are relatively greater in electrical service. Hence the Board recommends that if the company shall continue to impose a minimum monthly charge upon its customers who pay the maximum prevailing net price, such charge shall not exceed $1.00 per month per meter; and that, if on any June 30th it shall appear that a customer has, by reason of the minimum charge, paid or become liable to pay during the year immediately preceding an amount exceeding the minimum monthly charge multiplied by the number of months in which he has been a customer of the company and an average price for metered electricity exceeding the prevailing maximum net price per kilowatt-hour, the company shall refund all such excess.

It may be noted in conclusion that the Board states that nothing in its recommendation is to be construed to require the company to render its service at an average price per month less than the minimum monthly charge or at an average price per kilowatt-hour less than the prevailing maximum net rate.

The Gas and Electric Light Commissioners of Massachusetts have also rendered an important decision on another phase of the same subject, this being a case involving the minimum electric rates in use in the town of Leominster. Both the facts and the conclusion of the Commissioners are sufficiently stated in the following quotations from their opinion:

"On May 29, 1909, * * * the Board recommended that on and after the first day of June, 1909, the net price charged by the Leominster Electric Light and Power Company for electricity shall not exceed sixteen cents per kilowatt-hour. * * *

"It appeared that on June 1, 1909, the company discontinued the schedule of prices for commercial lighting * * * and adopted, in place thereof, a gross price of eighteen cents per kilowatt-hour, with a discount of two cents per kilowatt-hour for prompt payment and a minimum monthly charge of $1.00. No change was made in the power rates, which are set out in detail in the Board's decision, and include a monthly service charge based upon the horsepower of the customer's motor, independent of and in addition to the charge for the current consumed. * * *

"In illustration of the effect of this method of charging, it appeared that for the month of June the town was charged $1.00 for a school-house to which no electricity was supplied, $1.00 for a stable to which three kilowatt-hours of current were supplied for light, $5.54 for another school-house to which eight kilowatt-hours were supplied for power, and $5.77 for the same school-house to which thirty-four kilowatt-hours of energy were supplied for power through another meter. * * * The important question is whether or not the company is now fairly complying with the recommendation of the Board.

"During the hearings in the original case there was no complaint of the minimum monthly charge of $1.00 made to the lighting customers. A charge of this character is a common feature of electric light schedules. It is not a service charge or meter rent imposed in addition to the actual charge for current. * * * The monthly service charge made to power customers is of a different character. It is plain that this charge may, indeed has in two cases already described, compelled a small user of power to pay much more than sixteen cents per kilowatt-hour for electricity supplied by the company. Complaint was made of this charge at the hearings in the original case and was met by the company, to some extent at least, by raising a question as to the Board's jurisdiction over rates for this kind of supply.

"This question was considered and discussed in the decision of the original case. The Board pointed out that its duty under the statutes seemed to be to determine 'the fair price at which the company is bound to supply electricity to

any one who may apply for whatever use,' and that if there are to be differentials in rates, 'they must be upon the initiative of the company rather than the Board.' * * * In view of these facts any scheme of rates which, otherwise than through the monthly minimum charge of $1.00, may in its operation cause the price of electricity for any use to exceed sixteen cents a kilowatt-hour, is not, in the opinion of the Board, a fair compliance with its recommendation. * * * The Board therefore recommends, in furtherance of its decision of May 29, 1909, that the company immediately offer to sell electricity for any use at a net price not to exceed sixteen cents per kilowatt-hour, with such minimum monthly charge not exceeding $1.00 per month as it is now employing with respect to its lighting customers; that the company adjust with its customers, who elect to be served at the rate fixed by the Board, any excess actually charged them over and above the amount which they would have been charged had the foregoing recommendation been put in force on June 1, 1909; that, if a customer elects to be served under such other schedules for light or power as are now or may hereafter be in force, whenever the charges for such service for any year thereunder aggregate more than sixteen cents per kilowatt-hour for the elctricity so supplied to him, the company shall restore to him such excess; and that the company shall, as promptly as is consistent with the fulfillment of current contracts, if any exist, discontinue giving or offering any advantage to one customer not open to all who enjoy or seek the company's service under like conditions."

THE PROPULSION OF STEAMSHIPS.

Much has been written of late on the subject of steamship propulsion, and many excellent papers have recently been read before the various engineering societies showing forth the possible advantages of systems involving more or less radical changes from existing practice. The remarkable performances of some recent ships fitted with steam turbines, have elicited a great deal of praise from the advocates of the steam turbine, and much criticism from some others who are not so enthusiastic.

Two noteworthy contributions to the controversy appear on other pages of this issue,—one an article by Engineer Vice-Admiral H. J. Oram, of the British Navy, on "The Electric Propulsion of Ships," extracted from his presidential address, "Propelling Machinery of Warships," delivered at the recent inaugural meeting of the Junior Institution of Engineers, in England,—and the other an article entitled "The Melville and Macalpine Reduction Gear," the material for which was obtained mostly from a pamphlet written by Mr. George Westinghouse, head of the Westinghouse companies in America. Both of these men are unquestionably of the highest authority.

Vice-Admiral Oram, while elucidating no new features in the problem of the electrical propulsion of ships, presents a remarkably dispassionate and critical review of the situation, and his observations will be read with much interest.

Mr. George Westinghouse also speaks with the weight of much authority, although some of his observations on the performances of steam turbines already installed in large steamships, are not quite in accord with the facts of the case. For instance, in the pamphlet referred to above, Mr. Westinghouse says: "From the best information obtainable, it is believed that the steam consumption of the *Mauretania* and *Lusitania* cannot be less than 14.5 pounds per shaft horsepower per hour, while it has been demonstrated beyond question that in turbines of similar capacity operating at speeds which the reduction gear makes possible for marine service, the steam consumption does not exceed 11.0 pounds per shaft horsepower per hour."

This would seem to infer that the best type of steamship turbine was not capable of working at an efficiency greater than 14.5 pounds of steam per shaft horsepower per hour, whereas Vice-Admiral Oram, in another part of his presidential address to the Junior Institution of Engineers, states that in the three British warships of the *Indomitable* class, an efficiency of 12.0 pounds of steam per shaft horsepower per hour is attained with the engines working at full power. This would not, however, invalidate Mr. Westinghouse's claim that the reduction gear would not effect a considerable economy, although it would appear that the economy would not be quite so great as he supposes. Of course the real problem, with warships having turbine engines, is the present apparent necessity for separate cruising turbines, which, if the reduction gear were employed, would not be needed.

Although the results attained by the Melville and Macalpine reduction gear are undoubtedly phenomenal, it is impossible to state definitely at this time whether or not the gear would be successful in a prolonged test under actual working conditions as obtain at sea. Until such a test has been carried out for many months on a sea-going vessel of great power, it is questionable whether existing and projected shipbuilding plans will be much disturbed.

The same remarks also apply to the various electrical methods of ship propulsion that have been proposed, although much is expected of designs employing producer plants and internal-combustion reciprocating or turbine engines coupled by electrical generators and motors to the propellers. However, there is no means of knowing how any of these things will work until they are tried.

Mr. Westinghouse's performance in proposing and financing the proposition of evolving a workable reduction gear, is much to be commended, and it is to be hoped that his efforts and those of the clever inventors he has sponsored, will ultimately be crowned with the success they deserve. Even if the gear should not be an unqualified success at sea, there seem to be plenty of opportunities for it in machine shops and factories on land.

Marconi's Work in Wireless Telegraphy Rewarded by Nobel Prize.

The Nobel prize for physics has this year been awarded to William Marconi for his extended researches and developments of wireless telegraphy, and also to Professor F. K. Braun of Strasburg University, Germany, for his researches in radio-activity. The Swedish Academy of Science, to which is given the duty of annually selecting the scientists and great public leaders whose work has been of the greatest value to the human race, was unable to decide in regard to the prize for physics between these two men, and therefore decided to award the honors between them.

This prize amounts annually to about $40,000. Since it was divided this year, each of the two recipients will receive $20,000. The prize will be awarded formally on December 11 at Stockholm, Sweden.

The honor that has come to Mr. Marconi is a peculiarly appropriate recognition of his very effective work in developing wireless telegraphy. The main facts connected with his career are common knowledge.

William (Guglielmo) Marconi was born April 25, 1874, near Bologna, Italy. Before he had reached the age of twenty he was already something of an inventor, as he had devised an apparatus by which he sent signals through the walls of his father's house without the use of any connecting wires. In the few years following 1894 he lent himself entirely to his experiments on wireless telegraphy, and when he went to England in 1897 he was already prepared to send messages five miles. Since that time the extension of the distance that could be covered has been progressing steadily with improvements in his apparatus. October 17, 1907, was marked by the beginning of regular transatlantic communication by means of wireless telegraphy between the Marconi stations at Clifden, in Ireland, and at Glace Bay, Nova Scotia. The work of Marconi and the importance of wireless telegraphy attracted considerable attention when the steamer *Republic* was saved through the aid of wireless telegraphy after a collision last winter. This showed the immense value of the radio-graphic equipments for all maritime vessels. Although many have taken prominent parts in the rapid progress of wireless telegraphy, to Marconi doubtless belongs the greatest credit for making it a commercial success.

Lectures at the Stevens Institute.

The Stevens Institute of Technology, Hoboken, N. J., possesses an enterprising engineering society which is affiliated with the American Society of Mechanical Engineers. This society has recently issued a neat little pamphlet containing a programme of lectures announced for the session of 1909-1910. This list of lectures is so good that the dates ahead are given in full below, and it will be noticed that the speakers are nearly all men of national prominence in the engineering industries:

December 14, "Essentials of Naval Efficiency in an Age of Engineering," by Rear-Admiral G. W. Melville.—January 4, "Engineering Efficiency," by Henry G. Stott.—January 11, "Warfare of the Future," by Hudson Maxim.—January 18, "Features of Electrical Development," by T. Commerford Martin.—February 8, "Pavements for City Streets," Samuel Whinery.—February 15, "Power Plant Economies," by David S. Jacobus.—February 21, "The Engineer as a Manager," by Henry L. Gantt.—March 1, Lecture by John F. O'Rourke.—March 8, "Automobiles," by Herman F. Cuntz.—March 15, Lecture by W. J. Hammer.—March 22, "Arts and Industries of the Orient," by Charles R. Richards.—March 31, "The Gyrostat and Its Applications," by George V. Wendell.—April 5, "The Theory of Gyroscopic Motion," by Louis A. Martin.—April 12, "Methods and Systems in Relation to Handling Concrete Work," by Frank B. Gilbreth.—April 19, "Notable Examples in Modern Construction," by John C. Ostrup.—April 26, "Development of the New Navy," by Naval-Constructor David Watson Taylor, U. S. N.—May 3, "Immortality," by Charles F. Kroeh.—May 10, "The Contributions of Photography to Our Knowledge of the Stellar Universe," by John A. Brashear.

Each lecture is timed to begin at 4:10 p. m., and it will be noticed that all the above dates are on Tuesday.

Denver Electric Club Organizes.

Following the excellent practice of the electrical men in our large centers to organize into clubs for weekly meetings of a social and business character, the leaders of the electrical fraternity in Denver have started a movement for the organization of the Denver Electric Club. The originators of the idea were C. F. Oehlman, of the Denver Gas and Electric Company, and J. B. Griffith, of the Nernst Lamp Company's Denver office. At a luncheon held at the Chateau Lafayette in Denver, on December 1st, the project took definite shape and was enthusiastically received by an aggregation of nearly thirty prominent representatives of the Denver electrical interests who were present. It was decided to hold the first regular meeting on December 8 in connection with a luncheon to be given at the Kaiserhof Hotel. At this meeting the organization will be perfected and the officers elected.

New York Public Service Commission Appropriation.

To carry on its work next year and perform the duties prescribed under the law of 1907, the New York Public Service Commission, First District, has laid before the Board of Estimate and Apportionment of New York city a requisition for $1,093,274. The letter in which this sum is asked for details the chief classes of expenditure by the commission. For special purposes the sum of $58,300 is asked, and $25,000 for contingencies, but apart from the regular maintenance charges the great bulk of the total, amounting to $931,994, is to be apportioned to the class which includes executive, engineering, statistics, franchises, gas and electricity, legal and transportation bureaus, salaries and disbursements, including stationery, library supplies, printing, maps, plans and engineering supplies.

The grand total to be provided by the Board of Estimate does not, however, cover the entire cost of the commission, as the salaries of the members of he commission, their counsel and secretary are paid by the State of New York. The commission further states that no estimate can be made now and additional requisition will be necessary hereafter for the expenses of legal proceedings in getting consents for rapid transit routes and other incidental charges.

A New Long-Distance Transmitter.

The London *Electrician*, quoting the *Austrialian Mining Standard*, states that M. Moloney, of the staff of the Auckland (N. Z.) telegraph office, has invented, in conjunction with John Ross, of the Christchurch (N. Z.) office, a long-distance telephone transmitter known as the "tandem looseback," which he proposes to place before telephone experts in England. The transmitter is a device constructed on the principle of the human ear, and it is claimed for it that by means of it long-distance telephoning is greatly facilitated, and for ordinary use conversations can be carried on in whispers by persons using the telephone in crowded rooms where others are talking. It is Mr. Moloney's intention when in England to ascertain whether or not his invention has been forestalled, and, if not, to place it on the market. It is also stated that Mr. Ross intends visiting the United States in order to place the invention before the telephone companies in this country.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

ANNUAL CONVENTION AT CHICAGO, DECEMBER 7, 8 AND 9.—FIRST DAY'S PROCEEDINGS.

In view of the recent mergers and rumors of combinations that have aroused the independent telephone interests throughout the country, the annual meeting of the International Independent Telephone Association, which began on December 7 at the Auditorium Hotel, Chicago, Ill., has attracted an unusual amount of interest.

The meeting, at which about 200 members were present, was opened by Vice-President P. C. Holdoegel, who introduced B. J. Mullaney, secretary to Mayor F. A. Busse of Chicago. Mr. Mullaney's short address of welcome to the association was responded to by Hon. E. B. Fisher of Grand Rapids, Mich., who has for many years been associated with the development of the telephone business.

Owing to the death of his business partner, President E. H. Moulton, of Minneapolis, Minn., was unable to be present, and therefore the secretary was called on to read the presidential address, which was a report of the progress made in the past year. The figures presented were in part obtained from the United States census and showed that the year 1909 was the most important in telephone development of any during the past twelve years.

It was an unexpected pleasure to hear Herbert H. Houston, vice-president of the Doubleday-Page Company, on the subject of advertising the telephone business. After giving some figures on the amount of advertising the Bell Telephone companies have been carrying, he gave estimates on the probable cost of an advertising campaign which could be carried out by the independent association.

The afternoon session was set apart as a technical and operating conference. Gansey R. Johnson read an outline programme of the session and mentioned a few papers which would be presented. The programme proper was opened by a talk on "Scientific Business Methods," by Harry N. Tolles of the Sheldon School of Chicago, in which he mentioned various ways of increasing the efficiency of the personnel of a company through salesmanship education.

The subject of education was discussed further by Prof. Arthur Bessey Smith, of Purdue University, in a paper on "The Telephone and the School." Professor Smith deplored the fact that the independent companies did not secure enough technically educated men, who could doubtless aid the company to a considerable extent.

Professor Volney D. Cousins, also of Purdue, read a paper on "Telephone Problems and Suggestions," in which he impressed the value of practice as a necessary addition to the technical training of an apprentice. Some telephone companies already offer such apprenticeship courses.

Following along the educational line Kempster B. Miller dealt with the "Economy of Proper Engineering," showing how such engineering could he carried out by properly trained men. When the properties of a telephone company are not showing proper dividends, it is the duty of the engineer to gradually bring about operating conditions which will allow of a better profit. Forecasts of the service expected in five or in twenty years must be made, and the equipment must be such as to meet this service demand with the least alteration.

After a brief discussion of Mr. Miller's paper the meeting was adjourned until Wednesday morning.

The report of the Wednesday and Thursday sessions of the convention will be given in the next issue.

Telephone Inquiry in New York.

An investigation of the companies doing business in the city of New York is now in progress, and, from the amount of work mapped, will probably last six weeks longer. The committee, composed of Senator George A. Davis of Buffalo, Senator James Frawley of New York city, and a number of others has been appointed to examine conditions carefully and to decide whether telegraph and telephone companies should be subject to the Public Service Commission.

Any officials of the various companies can, by act of Legislatue, be compelled to appear before the committee and must on request allow inspection of the company's books. Furthermore, any subscriber who has a real or imaginary grievance is invited to explain it.

The recent telephone merger, which involved a $50,000,000 bond issue, is also to be investigated with respect to the possibility of over-capitalization and the benefits to be derived by the public from the combine. Should it be found that the Western Union and the Postal Telegraph companies are working under a secret rate agreement the committee is at liberty to recommend steps toward the breaking up of the combine.

Telephoning En Tour.

Something new in telephone work during an automobile run was developed the other day in Texas. One of the numerous reliability runs was conducted between San Antonio and Dallas. Among the entrants was D. A. Walker, the president of a telephone company, with a big Rambler car carrying a portable telephone.

By means of a long fishing pole with a hook at the end Mr. Walker was enabled at any time to ring up any connecting point along the lines without getting out of his car.

The usefulness of this member of the touring party can be appreciated by some of the things which Mr. Walker did for the party en route. One day, while many miles from any station, he made arrangements for the Governor of Texas to be entertained by the auto men at dinner where the night stop was made. If the car broke down the wire along the roadside was tapped and messages for relief were promptly sent. Points ahead were kept well informed of the progress of the cars, from time to time, and the usefulness of the plan was demonstrated many times.

Manhattan Bridge Opening.

It is announced that the roadway of the new Manhattan Bridge connecting the boroughs of Manhattan and Brooklyn, New York city, will be opened on December 24. No elaborate celebration in connection with the event has been planned. The mayor and several city officials will be driven across the roadway, and it will then be thrown open for vehicle traffic. Neither the footpath nor the railroad tracks will be ready for some time.

The work of changing the grade of the Second Avenue Elevated road so as to permit the bridge to cross over the tracks in Division Street has been completed.

Nothing has been done regarding railroad transportation across the new span. The plans provide for eight tracks, two on each side of the roadway.

November Meeting Pittsburg Electric Boosters' Club.

A brief mention of the meeting of the Pittsburg Electric Boosters' Club that was held on November 29, was made in these columns last week. Further details regarding this meeting and about this unique club have been received and from these the following has been prepared:

The Pittsburg Electric Boosters' Club includes in its membership representatives of all of the electrical interests in Greater Pittsburg. It is organized on the lines of similar clubs in other cities, and yet embodies in its essentials distinctive points among which may prove of interest the designations given to its officers, who are as follows: L. J. Kiefer, master controller; A. H. Harris, auxiliary master controller; Ludwig Hommel, recording wattmeter; C. B. Cushing, master electrotype.

The club has monthly meetings, usually spoken of as "short-circuits," and a weekly dining club. About 150 members were present at the meeting, which was held at the Hotel Duquesne in Pittsburg.

A. P. Munning, the general sales agent of the Cutler-Hammer Manufacturing Company, addressed the club on this occasion on the subject of "Seventeen Years of Development in the Controller Industry." In introducing Mr. Munning, President Kiefer referred to his long connection with this phase of the art, dating from 1892.

The speaker first touched on the fact that with the development of power-saving appliances when used with electric motors, the question of proper controllers had become so important as to practically dominate to a large extent the use of motor appliances, comparing it in this respect with conditions existing seventeen years ago, when the controller was looked upon as purely a necessary evil in connection with the motor, and was designed essentially by rule of thumb. For instance, in 1892 a one-horsepower, 220-volt starting rheostat, without any automatic features, sold for approximately $20 to $25, its dimensions were 24 by 24 by 18 inches, and its weight about sixty pounds; today the same device with automatic features sells for approximately $3, its size is 9 by 9 by 4 inches, and its weight 11 pounds.

Mr. Munning referred at some length to the development period occurring between 1892 and 1896, and beginning with a very simple automatic release, he outlined the various steps which had taken place since that time in the design and manufacture of controllers up to, for example, the intricate and massive controllers at present employed in seel-mill service at Gary, Ind., and at Aliquippa. As an instance, he spoke of the 1,500-horsepower, 220-volt, multiple-lever type speed regulators used at the Edgar Thomson works of the Carnegie Steel Company, where the final contacts on the controller are arranged to carry 10,000 amperes, and the resistances for each controller consist of approximately 5,000 feet of culm T rails. He also referred to the extensive use of self-starters in connection with compressors, valve-control systems, etc.

In reference to the subject of printing-press control, Mr. Munning described in a general way the types of controllers used for this purpose, beginning with the Hoe sextuple and octuple presses down to the simplest form of controllers for presswork used with the ordinary cylinder or flat-bed types.

In the use of larger motors for steel-mill work, attention was called to the application of the series-relay type of controller, and the speaker stated that before the advent of this construction, mill tables were not as successfully operated, since the drum-type control previously employed involved a much greater strain on the machinery, required harder service on the part of the operatives, and involved the use of a larger amount of time than with the new types. It was pointed out that the motors on mill tables are often required to be reversed from full speed in one direction to full speed in the opposite direction under full-load conditions in from three to four seconds, approximately seven times per minute, for twenty-four hours per day and six days per week, all of which required the most rugged types of controller construction that could be designed.

Mr. Munning also spoke of such uses of controllers as those in operation for ringing the chimes in the Metropolitan Tower of New York, operating the lighting circuits at the New York Hippodrome, and operating the turret-turning gears for the newer battleships of the United States Navy, and pointing out that practically the only limit to the use of controllers was the application of motors. Emphasis was placed on the fact that the controller industry has now become so distinctly specialized that one manufacturer alone in this field has now listed in his catalogue 3,000 standard types of controllers, and was manufacturing from 4,500 to 6,000 special controllers per annum.

When the large number of companies manufacturing controllers as a specialty is considered, some idea of the volume of this business can be gained. The manufacture of controllers and their specialization had become the crux of the motor situation, for in order to make new applications of motors, and have present applications perform their functions correctly, the controller is the vital point in most operations where predetermined cycles must be obtained.

Chicago Electric Club.

The meeting of the Chicago Electric Club on Wednesday, December 1, was a departure from the regular schedule, it being devoted to a business session. The reports of the secretary, treasurer, membership committee, speakers' committee and civic committee were read and adopted.

In the order of new business a motion was made and carried that the club hold an entertainment in the near future, the details of which are to be arranged by the entertainment committee. This committee is to report the result of its work to the club at its next weekly meeting. Much discussion ensued regarding the financial end of the entertainment, some members desiring the club to stand the expenses while others contended that tickets should be sold to defray expenses. The question was finally settled by a motion, which was subsequently passed, to the effect that the club guarantee fifty dollars to apply towards the expense of the entertainment, the balance to be provided by the sale of tickets.

C. S. Howlett, formerly president of the club, was present and following the business session delivered a brief address in which he compared similar electric clubs in the East with the Chicago Electric Club and drew the conclusion that he has visited no other club which could claim the same congenial membership as the Chicago Electric Club.

Late newspaper reports state that the Chicago & Milwaukee Telegraph Company has been bought by the Continental Telephone and Telegraph Company, thus affording an entrance into Chicago for independent telephone and telegraph lines.

METHODS AND COSTS OF UNDERGROUND CIRCUIT CONSTRUCTION.

BY CLARENCE MAYER.

As the purpose of this article is to compare methods and cost of constructing underground conduits for electric transmission lines and railway signal lines, the construction of manholes, while strictly a part of underground conduit work, will not be treated because the great variety of designs, materials and methods really requires a separate article for their description. Besides, no true comparison of manhole construction methods and cost could be made, as manholes of different designs and sizes are required for street railway, electric light and power, telephone, telegraph, and railway signal conduits.

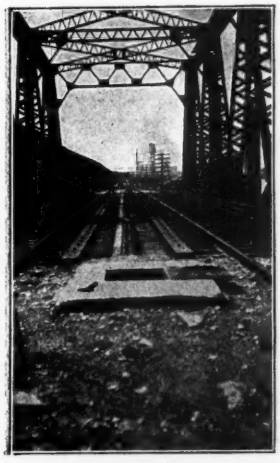


FIG 1—USE OF IRON PIPE CONDUIT ON A BRIDGE.

This does not hold true of conduits itself; for a conduit which is free from deterioration, proof against electrolysis and fire, has a smooth bore, and is quickly and cheaply laid, is practical for all classes of underground electrical transmission. These are fundamental axioms, and will readily be accepted without question.

In this article the writer will give his conclusions from the result of his experience in the actual construction of several million duct feet of underground conduit. In this work careful cost data were collected on the installation of more than 600,000 trench feet of city and country conduit work, involving both large and small jobs and many kinds of conduit construction under many sorts of conditions.

For the information of those who have never given underground conduit work much thought, a brief description of the most prominent kinds of duct now installed may be pertinent. These may be roughly divided into three classes: First, conduits of metal material; second, conduits of vegetable material; third, conduits of silicious material.

In the first class are wrought-iron pipe and cement lined wrought-iron pipe.

In the second class are paper or fibre conduit and creosoted pump log.

In the third class are cement or stone conduit, single and multiple vitrified clay conduit, and monolithic concrete or cement conduit.

Conduit of metal material is rarely used except for continuing conduit over a bridge or trestle, for terminating a lateral, or for short subsidiary conduit. Its cost and corrosiveness makes its use almost prohibitive. (See Fig. 1.)

Although several types of monolithic conduit have been installed in recent years, mostly in St. Louis, this kind of conduit has some disadvantages. These are the length of time required for its installation, the difficulty of breaking into it without injuring cable where repairs are to be made due to a bad burnout or where an additional manhole or service box is required, the difficulty in securing the experienced labor required in monolithic construction, the expense of such labor and the liability of heterogeneous and defective construction incident to all molded concrete and cement work which must be done quickly and underground.

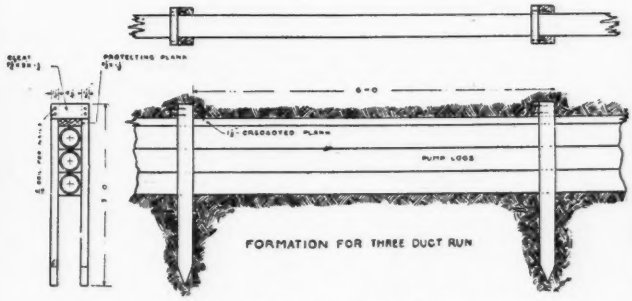


FIG. 2—VARIOUS SECTIONAL VIEWS OF PUMP LOG CONSTRUCTION.

The length of time required to install conduit is important not only from a standpoint of cost and utility, but also because work in city streets must be quickly completed to avoid interruption of traffic and complaint of property owners. In practical conduit work it rarely happens that the cement or concrete work is without defects, except, perhaps, where the work is very carefully done by experienced and skilled men which means additional time and cost.

It has been found that different batches of concrete are not always uniform in composition or consistency. It is therefore obvious that any conduit which is built entirely of this material is liable to be defective. Another negative feature of monolithic concrete conduit is that it is not entirely electrolysis-proof.

This latter objection is also made against cement or stone conduit and it is a very important objection, for the great damage done to underground cables by the ravages of electrolysis amounts annually to a large sum of money, irrespective of the losses through interruption of service incident to such cable injury.

Concrete is generally porous enough to allow saturation of the mass by the acid and alkali solutions constantly present under streets. And though the mass itself may not be materially weakened by this process, the eroding solutions are allowed to seep quite freely through to attack the cable sheath. The concrete surface lying next to the cable becomes softened, scales off and distributes its debris through the duct so that in time the duct is of no more use for exchange and repulling of cables than the disqualified iron pipe.

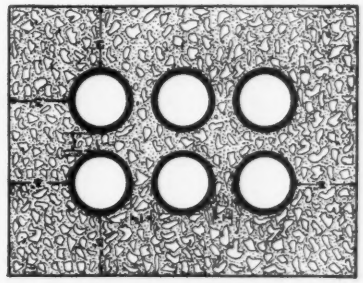


FIG. 3—FIBER CONDUIT WITH USUAL CONCRETE ENCASEMENT.

Another detrimental feature of cement or stone conduit is its brittleness. It is rarely a load is hauled from cars or storehouse to the work with a breakage of less than six or seven per cent.

Cement or stone conduit is of circular shape and usually made in three or six-foot lengths with slip joints on either end. It is usually laid in an envelope of concrete three inches in thickness; the lengths are butted together within the alining collar of iron which

fits over the slip joints. In multiple conduit construction the ducts are built up in tiers, the formation being retained in place by clamps or by stakes driven into the bottom of the trench and removed upon completion of the side walls. Cement or concrete is placed and flushed between the layers of ducts so as to make a solid construction. Where two or more ducts are laid side by side all joints are staggered.

Most of the underground conduits installed today are either single or multiple clay duct, fiber or creosoted wood. The preference is often caused by the market price of conduit materials and freight from factory to point of installation. In too many instances the first cost is the main item of consideration. There are, however, some conditions besides cost of material and installation that should dictate the kind of conduit to be laid.

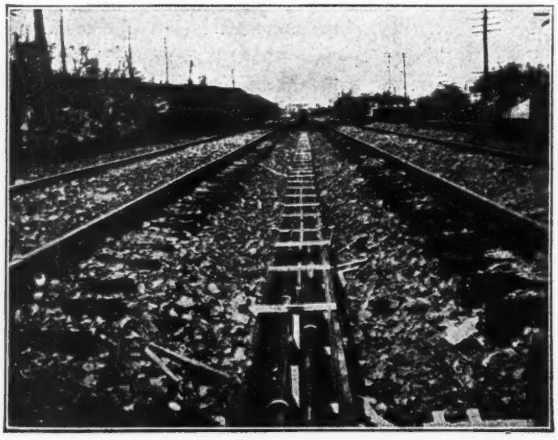


FIG. 4—WOODEN RACKS FOR FIBER CONDUIT LINE, SHOWING HOLDING STAKES.

FIG. 5—WOODEN RACKS AND CONCRETE ENCASEMENT FOR FIBER CONDUIT LINE.

For example, in localities where much water has to be contended with or where conduit is subject to constant and severe shocks, as in the yards of great steel plants and the like, creosoted pump log is most practical. In streets crowded with underground pipes or where it is desired that ducts be isolated from each other in order that ground currents may be equally distributed over the greatest possible area of cable sheath, to minimize the local electrolysis, such as in street-railway conduits, single-duct tile should be laid.

Creosoted pump log, though most practical under certain conditions, cannot be said to compare for general conduit construction with either fiber or vitrified clay conduits in durability or insulating qualities, and its cost is greater than either fiber conduit or vitrified clay conduit, as the ducts cost more and the creosoted stakes, cleats and protecting plank cost more than concrete and labor in mixing and placing.

Creosoted pump log is generally laid without any special foundation. Where two or more ducts are required they are laid so as to break joints. Each duct is provided with mortise and tenon which simplifies alinement. When the pump log is laid and settled in position, a creosoted plank usually one and one-half inches thick and of the width of the conduit is laid on top of the ducts. Stakes are then driven, one on either side, three inches by one and one-half inches by three feet, of creosoted lumber. These stakes are driven at intervals of six feet, are sharpened to a point and are driven with the three-inch face parallel to the line of conduit. The tops of the stakes are bound together by a cleat, of the same size lumber as the stakes. The methods of installing pump log is shown by Fig. 2. There are other and cheaper methods of installing permanent and solid construction. Were either stakes or creosoted plank to be omitted, the formation would have no protection from foreign excavations which experience has shown to be imperative.

Fiber conduit is usually laid in a three-inch envelope of concrete. Where two or more ducts are required the ducts are laid so as to leave an interstice between the ducts of one inch. Ducts are alined by means of male and female slip joints with which each length is provided, and in laying, the joints of each length are dipped in a liquid compound which seals the joint. Where the conduit cross-section is large it is built up in tiers and the formation is held in place by stakes driven into the bottom of the trench or by removable guide racks at intervals of six feet. As each tier is laid, concrete is flushed into the interstices between ducts and to a thickness of one inch on top of the ducts. The next tier is then laid and similarly concreted. (Fig. 3.) Where, as in railway signal conduit construction, ducts are laid between rails or tracks, and it is desired to concrete the entire formation in a single operation in order not to impede traffic or in order to cheapen construction cost, one-inch duct supports or guide racks are placed at intervals between tiers of ducts both horizontally and vertically, and the whole formation is held in place by stakes driven into the bottom of the trench on either side of the conduit formation. (See Figs. 4 and 5.)

A vitrified clay conduit line when composed of a single duct is laid in a matrix of three inches of concrete. Where multiple-duct tile is laid, the trench is prepared with a foundation of three inches of concrete. (Figs. 6 and 7.) Upon this the tile is laid, and if multiple ducts are used, the ducts are centered by means of dowel pins which preserve alinement. The top

and sides of each tile joint are covered with a strip of burlap six inches wide to prevent the entrance of concrete, and all joints are staggered. The formation is then enclosed at the sides and top with a wall of concrete three inches thick. Another and more economical method of installing vitrified clay tile which, after a series of experiments covering several years, has been adopted by the Chicago Telephone Company and by other large companies in most of their work, except in congested districts, is to lay the tile on a four-inch concrete foundation which is wide enough to extend three inches beyond the outer walls of the conduit formation. On this foundation the tile is laid as already described, except that the tile joints are protected by dampened strips of muslin or burlap, dipped in neat cement paste extending smoothly over the end of each section of conduit at least three inches on each side of the joints. After the joint has been made, the entire surface of the muslin or burlap is covered with a three-eighths-inch layer of one to one mortar. The sides of the trench are then filled with earth to a height level with the top of the ducts and a layer of concrete three inches in thickness is placed over the ducts, extending three inches on each side beyond the outside line of the ducts. This method of construction is shown by Fig. 8.

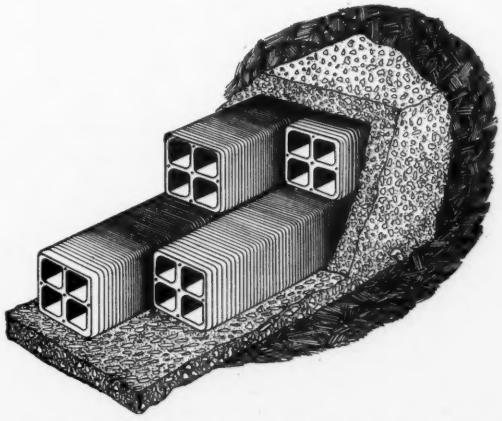


FIG. 6—STANDARD MULTIPLE-DUCT, CLAY CONDUIT CONSTRUCTION WITH COMPLETE CONCRETE ENCASEMENT.

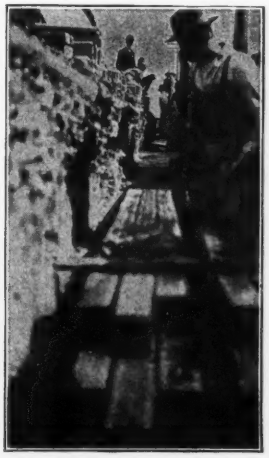


FIG. 7—SINGLE-DUCT CLAY CONDUIT CONSTRUCTION WITH COMPLETE ENCASEMENT.

The cost of underground conduit construction while variable and depending on the location of work, size of job, rates of wages, price of material and competence of foremen, may still be figured with accuracy provided the data used are based on average cost of work done under average conditions.

It is often assumed that cost data to be of any value for comparative purposes must be based on work done under approximately similar conditions. Of course, to secure such data is obviously improbable, as it does not often occur that two conduit lines are built under similar conditions, of the two kinds of duct which it is desired to compare. However, this is by no means necessary, for where distance of haul, character of soil and pavement, rates of wages and price of material are known and the cost data are carefully and systematically collected, they may serve as accurate bases for comparing or estimating. This is now generally recognized by cost statisticians and the writer's personal experience has proven this beyond question.

As an instance of this, the writer, when cost statistician for the Chicago Telephone Company, estimated the cost of installing a multiple duct conduit from Forty-eighth Avenue in the city of Chicago to La Grange, Ill. (a distance of approximately 38,000 feet), and he came within less than $100 of the actual cost. This is not an isolated instance. Similarly close estimates have been made by others where based on actual cost records.

The accompanying cost table is based on average costs collected by specially trained men using an identical system. They are not averaged from timing a few feet of work but from complete jobs, small and large, done in both city and country districts. On one job alone 824,862 duct feet of conduit was installed. This work was done by the Chicago Telephone Company in combination with the American Telephone and Telegraph Company to extend their conduits from Chicago, Ill., to Kenosha, Wis., and is one of the longest underground conduit lines ever built. The writer personally superintended the collection of cost data on this work and daily detail records of cost were kept.[1] These data together with those collected on many other conduit jobs are used as a basis for averaging the costs given in the following table:

COST OF FOUR-DUCT VITRIFIED CLAY CONDUIT.

	Single-duct tile enclosed in concrete	Multiple-duct tile enclosed in concrete	Multiple duct tile, concrete top and bottom
Costs of ducts at factory.	.1600	.1600	.1600
Concrete	.1522	.1463	.0915
Burlaps for joints (no burlaps used for single tiles)	.....	.0043	.0043
Mortar for joints	.....	.....	.0051
Breakage	.0040	.0040	.0040
Trenching	.1291	.1252	.1252
Backfilling	.0384	.0376	.0269
Unloading and distributing conduit	.0096	.0091	.0091
Laying ducts	.0111	.0093	.0093
Placing concrete	.0107	.0068	.0042
Mixing concrete	.0239	.0222	.0076
Disposal of surplus earth.	.0336	.0321	.0167
Supervision 5% of total...	.0286	.0279	.0232
Total cost per trench foot	.6012	.5848	.4871
Total cost per duct foot.	.1503	.1462	.1218

Rate of Wages.—The following were the rates of wages paid for a nine-hour day:

Foreman	$3.50 to $4.00
Assistant foremen	2.50 to 3.00
Timekeepers	2.00 to 2.50
Watchmen	2.00
Waterboys	1.00
Laborers	2.00
Teams and drivers	5.00

Concrete.—Concrete is based on cement $1.65 per barrel, sand and gravel $1.90 per yard delivered on the ground, mixed in proportion of one part cement, four parts sand and eight parts stone. Concrete was mixed by machine where possible. A considerable section of trench was excavated and graded and then the mixer was drawn along the side of the trench and an entire section of trench bottomed. The ducts were then laid and concreted on sides and top in one operation.

Laying Conduit.—Conduit was laid by unskilled labor. Two men were used in the trench and one handing conduit, dowel pins and preparing burlap or compound for joints as the case might be. The conduit layers were usually picked men and kept continually on this work.

Resurfacing.—All pavements except in unimproved and macadamized streets and roads were repaired by con-

1 For fuller details of this work the reader is referred to the writer's book on "Telephone Construction: Methods and Cost," Chapter VI; Myron C. Clark Publishing Company, Chicago.

tractors. In the cost table the resurfacing is not shown because there are many kinds of pavements, varying in cost in different localities, and whether the trench is a few inches wider for one construction than another makes no difference in cost of resurfacing, as paving contractors generally charge the same yardage.

Trenching.—The cost of trenching is based on average clay soil, which is the most usual soil encountered in this country. In trenching, any conduit requiring less than a fifteen-inch trench costs practically the same to excavate as a fifteen-inch trench. The reason for this is that a trench less than this width impedes the free working of the men, where a trench is deep enough to permit the top of the conduit formation to be two feet below street level as is generally required. Then, again, experience has shown that it is almost impossible to get men to dig a trench less than this width unless a foreman is placed over each man.

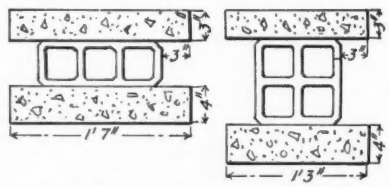


FIG. 8—MULTIPLE-DUCT, CLAY CONDUIT WITH PARTIAL CONCRETE ENCASEMENT.

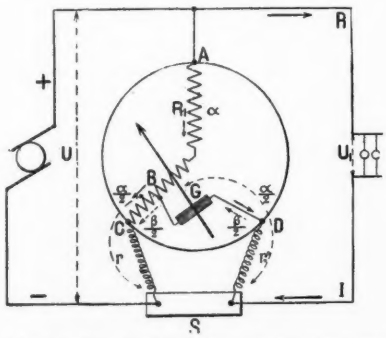
Unloading and Distributing.—Unloading and distributing conduit is based on an average load over average distances and road conditions being $.0023 per duct foot for vitrified clay conduit, with two-horse trucks costing $5.00 per day with driver, carrying five loads per day.

There are many points which lead one inexperienced to believe the cost of laying vitrified clay conduit is higher than it actually is. For example, it is often thought that a mandrel is required in laying multiple tile and that skilled men are needed to lay the tile. Of course a mandrel may be used, as may skilled men, but neither are necessary and neither are used by competent conduit men. If vitrified clay tile be laid as described in this article, it would be only necessary to run a cleaner through the ducts when rodding to remove any concrete which may have entered through joints, and this operation would add nothing to the cost of rodding.

Vitrified clay tile ducts are superior to many other kinds of ducts because they form a solid and permanent conduit, irrespective of the concrete envelope which only adds a secure foundation and protection from foreign excavations. Concrete on the sides of vitrified clay tile is more or less superfluous.

Compound Voltmeters for Indicating the Tension at the Distant End of Feeders.

In most electrical distribution systems the center of consumption is at a distance from the generating station and the tension must be maintained constant at these distant points. The original method of indicating the tension at the extreme end of feeders to the central station by means of pilot wires was costly and unreliable, and the indications of compound voltmeters with movable soft-iron armature now extensively employed are not very exact. Chauvin and Arnoux have recently found a solution of the problem, which is applicable to movable-frame as well as hot-wire instruments. As shown diagrammatically in the accompanying illustration, their compound voltmeter is an instrument with three terminals, *A C D*. The circuit *A B D* represents the ordinary voltmeter circuit comprising the frame *G*, movable in a magnetic field. A resistance *B C* joints the third terminal to the movable frame, and terminals *C D* are connected to a shunt traversed by the feeder current. If *I* be the current intensity in a feeder of resistance *R*, *U* the tension at point of origin and U_1 the tension at the point of utilization, then according to Ohm's law: $U_1 = U - RI$.



COMPOUND VOLTMETER FOR FEEDER LINES.

The resistances *BC*, *BB* being made equal by construction, the current in the coil of circuit R_1 is divided in half at *B* and is therefore of equal value in frame *G* and the auxiliary resistance *BC*, and the deviation of the movable frame is consequently proportional to the tension U_1 at the extreme end of the feeder. It is sufficient to indicate to the manufacturer the resistance of the feeder and intensity of the current it will carry. In accordance with these data he establishes the shut and adjusts the constants C_1 C_2, so that the voltmeter will directly indicate the tension U_1. With thermal voltmeters the arrangement is the same, the expanding wire being inserted between points *B* and *D*. In order to transfer the instrument to another feeder carrying the same current, but having a different resistance, it is only necessary to modify suitably and simultaneously the resistances *r r'*.—*From L' Electricien (Paris), November 6.*

Enjoins Two-Cent Trolley Rate.

Following up his Missouri decision adjudging the two-cent fare law unconstitutional where it can be shown that a railroad is unable to earn a reasonable profit, Federal Judge Smith McPherson granted a temporary injunction which forbids the Cedar Rapids & Iowa City Railway and Light Company from complying with the Iowa two-cent fare law. The hearing was set for December 15.

The action was based on a petition by Mrs. Elizabeth D. McClintock, of Haverford, Pa., a stockholder of the company. She declares the corporation is no longer paying dividends, and that the stockholders have been forced into the action to protect their interests. The injunction restrains Attorney-General Byers, the State Railroad Commissioners and two county attorneys from bringing action against the company to compel it to follow the law.

Conservation Course for Engineers.

Conservation engineering is a new course to be offered at the University of Michigan. Six years and a summer session will be required to complete the course for the degree of Master of Conservation Engineering.

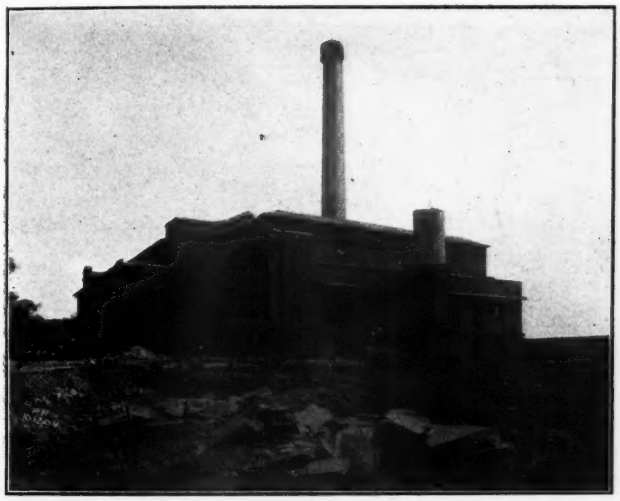
The new course is an outgrowth of the impetus given interest in national resources by the Roosevelt conservation congress two years ago.

No new branches will be taught, as the course is a combination of courses in the literary, law, and engineering departments. Its aim is to fit students to appreciate the natural resources of the country, to equip them for a better utilization of the same, and to enable them to give scientific attention to waste regions.

THE NEW CONGRESSIONAL HEATING, LIGHTING AND POWER PLANT AT WASHINGTON.

BY GEORGE H. DRAPER.

Within a short period there will be completed in the city of Washington, D. C., one of the largest and most complete power plants of its character in the country. A preliminary description of this plant appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 18 last. For some years the Congress of the United States has had under consideration the erection of a central power plant for furnishing heat, light and power to the group of costly government buildings known as the "Congressional Buildings," which include the United States Capitol, the House Office Building, the Senate Office Building, the new Congressional Library, and the proposed new structure which is to house the United States Supreme Court and some of the minor courts. This entire aggregation of buildings is embraced in an area of probably not more than four acres, and is approximately 3,500 feet distant from the central power station, which is located on a government reservation known as Garfield Park, just south of the United States Capitol grounds.



NEW CONGRESSIONAL HEATING, LIGHTING AND POWER PLANT AT WASHINGTON, D. C.

TURBINE ROOM, SHOWING TURBINES AND TURBO-GENERATORS IN PROCESS OF ERECTION.

The heating, lighting and power plant for the Congressional Buildings is a three-story modern steel-frame structure built of red brick and cement after the old mission style, with gracefully sloping tile-covered roof and twin ornamental buff brick stacks. The building is eighty feet in height. Reinforced concrete has been used throughout for all supports, floors and roofing, and the entire structure rests on a concrete pile foundation.

In connection with the plant there is a pumping station located on the river front, about 4,400 feet distant from the main station, for furnishing water for condensing purposes, and it is also the outlet for the overflow flume.

For the present there are to be four substations, one in each of the buildings forming the congressional group, and each is connected to the main station by a comprehensive system of concrete tunnels.

It has been uppermost in the minds of the engineers in charge of the construction of this plant that the buildings shall at no time be without proper service. To this end it has been arranged that all machinery and apparatus be in duplicate in so far as is consistent with expense, so that in case of a breakdown, from any cause, in any part of the system the other part is immediately available. There are checks and counter checks throughout the entire system so as to make it almost a certainty that it will never be necessary to suspend operation of the entire plant.

Foundation and Floors.—The foundation of the building consists of 750 concrete piles of Simplex construction, or about 15,000 lineal feet, covered with a concrete surface to the depth of several feet. The building is shaped like the letter T, the vertical stem, running north and south, being the boiler-room section, and the top of the T, abuting on the north, the turbine-room section. The boiler section is 160 by 87 feet, and the turbine section 112 by 85 feet. The boilers are on the second floor, fourteen feet above street grade, and immediately above the boilers on the third floor is the coal-storage loft. The ash-handling apparatus is directly under the boilers on the basement floor. The basement of the turbine section is occupied by a storage battery and the feed pumps; on the second floor of this section are the turbines and turbo-generators; on the mezzanine floor, running the entire length of the turbine room, is the switchboard gallery and the visitors' gallery. The bottom portion of this gallery is for the high-tension equipment, and immediately above this the marble switchboard, and then the visitors' gallery. A fifty-ton Shaw electric crane spans the upper portion of the turbine room.

Stacks.—The two stacks were constructed by the Alphonse Custodis Chimney Company and are each 212 feet in height by eighteen feet diameter at the base and eleven feet at the top, inside measurement. They have outlet doors on the outside of the plant for removing accumulations of soot. The stacks have each a red brick octagon-shaped pedestal or base forty-eight feet in height, and above this they are cylindrical in shape and built of buff-colored radial chimney brick. The stacks are lined inside with fire brick in fire clay from a point four feet below the flue entrance for a distance upward of twenty-eight feet, and from that point upward with Custodis radial brick. Between the inside wall of the chimney

and the fire-brick lining there is a two-inch air space for a distance of seventy-five feet from the flue openings, which are thirty-three feet above the street grade. The usual inside and outside ladders are provided and each chimney is surmounted with a twelve-section iron cap. Somewhat of a departure in brick stack building has been incorporated in these stacks, i. e., a smooth rolling bell-top head as an ornamental and graceful trimming to each chimney.

Boilers, Condensers and Pumps.—There are sixteen water-tube boilers of the Atlas make, comprising eight batteries. Each boiler is rated at 550 horsepower and has an evaporating capacity of 21,000 pounds of water per hour, at 212 degrees Fahrenheit and 175 pounds gauge pressure. The boilers are provided with mechanical stokers.

There are four barometric injector condensers, comprising two sets of two condensers each, and these are connected by a forty-two-inch cross and provided with a twenty-four-inch inclosed automatic exhaust relief valve, having hydraulic lifting cylinders.

Metropolitan injectors with Hancock swing check valves are used as a reserve precaution in case the boiler-feed pumps fail to operate from any cause, or if the load is such that they would be more economical to operate than the pumps.

In the basement of the boiler section are installed three feed pumps for the boilers, which are connected to the hot well and city pressure mains, any one of which is capable of supplying one-half of the plant, the third one being held in reserve. These pumps are of the balanced piston type, and equipped for outside adjustment.

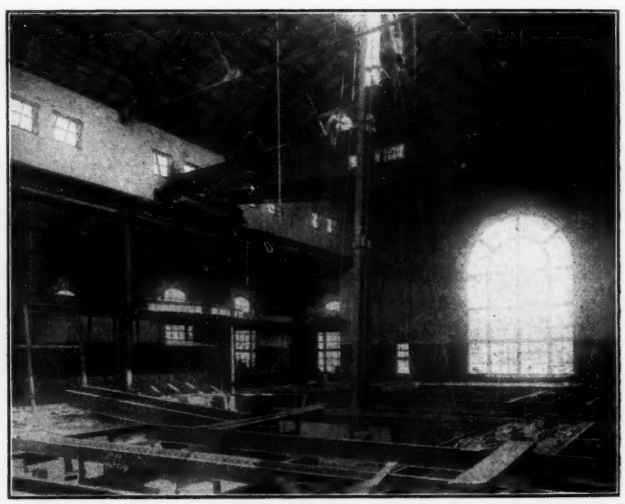
Two eighteen-inch vertical centrifugal circulating pumps are installed at the pump house, coupled direct to a 200-horsepower vertical induction motor. They have twenty-inch water openings, and each pump is capable of supplying sufficient condensing water for the above-mentioned condensers, delivering 150 gallons of water per minute and maintaining a head equal to fifty pounds pressure per square inch.

Water from the hot well is taken by gravity through a forty-eight-inch, inside diameter, concrete overflow flume to the river. Running parallel with this flume is the condensing water-pipe line. The latter is of extra heavy cast-iron thirty-six-inch pipe for about half the distance from the river end and of standard cast-iron pipe of the same size for the remainder of the distance to the condensers.

Coal and Ash-Handling Apparatus.—In connection with the boilers Roney steam-actuated mechanical stokers are used, automatically feeding coal to each of the sixteen boilers from chutes connected with the coal bunkers immediately above. Coal is delivered to these bunkers by means of belt conveyors. The coal is first dropped directly from the railroad cars, on a siding at the rear entrance of the plant, into a hopper, and then mechanically conveyed to and through coal crushers and thence to the loft conveyors. The ashes are automatically dropped into ash hoppers under each boiler and then in turn dropped into hand dump cars. These hand cars are rolled to an ashpit in the rear of the plant and from there are conveyed by means of ash skips to the top of the building and dumped into chutes suspended over railroad cars to be hauled away.

Generators and Turbines.—The generating equipment consists of four 2,000-kilowatt, 6,600-volt Westinghouse three-phase turbo-generators, direct driven by four 2,700-horsepower Westinghouse-Parsons steam turbines. The machines run at a speed of 1,500 revolutions per minute. There are four 37.5-kilowatt exciters connected at the ends of the turbine shafts. The turbines are equipped with an equalizing stop valve placed in the steam line and operated from a separate safety governor which automatically closes the valve when the turbine speed exceeds the safe limit; this safety stop can also be tripped by hand. The governor is so designed that it can be operated either by hand and has also an approved electric attachment so that the speed control may be effected from the switchboard if desired.

VIEW OF BOILER ROOM.



TURBINE ROOM SHOWING ELECTRIC CRANE.

Transformers and Motors.—There are installed in the station two sets of transformers, each set consisting of three 125-kilowatt, single-phase, twenty-five-cycle, oil-cooled transformers, for lighting the power station and furnishing power for the auxiliary apparatus; these transformers are Y-connected on the four-wire system and step down from 6,600 volts to 200 volts for motor circuits and to the standard pressure of 125 volts for lighting circuits, respectively.

In the pump house at the river front there are two 6,600-volt, 250-horsepower vertical-shaft induction motors which are so connected electrically as to be started either at the pump house or direct from the switchboard in the main

station. Three starting compensators are located in the basement of the power house under the high-tension section, and there is an emergency starting apparatus in the pump house.

Booster Set and Storage Battery.—The booster set consists of a 125-horsepower motor, direct-connected to a booster generator having a capacity of 845 amperes at sixty-five volts.

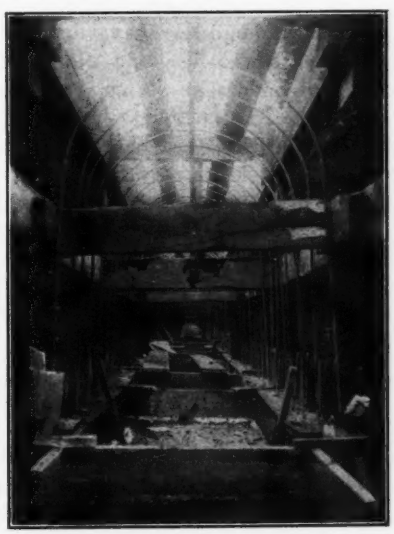
There is a seventy-four-cell storage battery of standard type, furnished by the Electric Storage Battery Company, of Philadelphia, Pa., which is used in connection with the exciter system; also for operation of the crane and for emergency lighting of the plant and substations in case of a breakdown or failure of the alternating current for any cause. The battery has a normal discharge rate of 200 amperes and of 800 amperes for one hour.

Switchboard, and High-Tension Structure.—The lower portion of the switchboard gallery is occupied by the high-tension structure, which is of concrete construction containing twenty, type E, electrically operated oil switches, with disconnecting switches on both sides thereof in order that they may be cut off for inspection. The high-tension busbars are of bare copper tubing, separated in the center by sectionalizing knife switches, thus enabling the system to be divided into two parts and operated separately. The structure is eighty-seven feet long and twelve feet high. It also contains the transformers for operating the instruments on the switchboard above.

The switchboard proper is constructed of white marble and is composed of nineteen panels, comprising four generator panels, five feeder panels controlling the feeders to the various substations, two panels for the storage battery, two for the exciters, one for the booster set, one for the pump motors, one for the station lighting transformers and three for station power service and substation lighting.

There is a somewhat new departure in the manner of the installation of emergency provisions. First duplication is used where it has been practicable and consistent with a reasonable cost. There are two sets of busbars, duplicate feeders, duplicate busbars for the storage battery, etc. There is an emergency panel for lighting the power house and all substations from the storage battery. Ordinarily these are lighted through the transformers in the basement, but it has been so arranged that, in case the alternating current is cut off for any cause, this circuit is automatically thrown on the storage battery, thus giving light immediately in the power house and substations.

Steam Tunnels.—The system whereby heat as well as lighting and power current are transmitted to the various buildings is no less interesting than the plant itself. Reinforced concrete tunnels, having an aggregate length of about 6,000 feet, built up on Blaw collapsible steel forms, have been constructed. These tunnels are seven feet high by four and a half feet wide, and are provided with suitable entrance manholes at various points of convenience. Steam is conveyed through wrought-steel piping with welded



VIEW OF TUNNEL CONSTRUCTION.

flanges. High-pressure steam is sent through this piping and reduced in pressure on reaching each of the buildings. From the plant to the nearest building a fourteen-inch pipe is used, from which point it diminishes in diameter to twelve inches and ten inches, with branches to the various buildings of nine inches and seven inches. These tunnels are electrically lighted and are so wired that an operator can turn on or off any series of lamps before and behind him as he goes. The steam pipes are arranged along one side of the tunnels and there is ample room for a good sidewalk. Electric current is transmitted through cables in vitrified conduits running parallel with the steam tunnels.

Cost of Construction and Maintenance.—The construction of this plant has cost the government approximately $1,500,000, and when completed it is estimated that the operating expenses will be between $20,000 and $25,000 annually. Owing to the very stringent smoke law in the District of Columbia hard coal has hitherfore been used exclusively in these buildings. The present plant, however, being located at a considerable distance from the buildings, together with up-to-date apparatus, will enable the use of soft coal at approximately one-half the cost. The Capitol at present uses from 7,000 to 10,000 tons of hard coal each year; the new Library from 4,000 to 5,000 tons; the office buildings are somewhat of a problem since they have not been in operation long. However, it can be seen at a glance what an enormous saving in coal alone is to be had, to say nothing of concentration of these various old plants in the one new central station.

The government supervision of the entire plant comes under Elliott Woods, superintendent of the United States Capitol building and grounds, and Christian P. Gliem, chief electrical engineer Westinghouse, Church, Kerr & Company, were the consulting engineers, and of this firm F. E. Caldwell, constructing engineer, had immediate supervision of the construction.

Important Telephone Merger.

Announcement was made recently at Harrisburg, Pa., that the American Union Telephone Company, which controls practically all of the independent telephone business in the state of Pennsylvania outside of Philadelphia and the territory of the Pittsburg & Allegheny company, of Pittsburg, had been purchased by the new Continental Telephone & Telegraph Company, of New York.

The transaction is said to give the new company immediate control, and will enable it to unite the American Union territory with that of the company in Delaware, Maryland, New York, West Virginia, Virginia, and New Jersey, where the company acquired the Inter-State company recently.

The American Union was formed several years ago to take over the business of various Pennsylvania independent lines, and had an authorized capital of $25,000,000.

Electrical Notes From Great Britain.

By Our British Correspondent.

The affairs of several English electrical undertakings which are operating in different parts of South America, have recently been receiving attention in London. One of these—the Rosario Electric Company, Limited—has experienced a thirty-two per cent advance in electric current sold during the past year; one-fourth of the whole was for motor power. The gross receipts advanced by $91,000, to $456,500. W. T. Western, chairman of the company, who recently returned from a study of the position in Rosario, records a remarkable general development of the town. While he was there, C. H. Merz, who was visiting the Argentine on other business, made a report upon the electric plant, and advised as to the best course to pursue in preparing for continuous development. At the present station there is room for more plant, and here by means of alterations and additions they could provide for a normal increase in demand for two or three, or even five, years ahead. It is thought, however, wiser to look forward for a longer period in view of the development alluded to, so land has been purchased at Sorrento, just outside the municipal boundary, where a turbo-electric generating station, capable of extension for many years, is to be erected. The cost of the station and equipment, with turbine and condensing plants, will be $500,000 or $600,000, with $1,000,000 as the total outlay, including cables and transformers. This expenditure will be spread over the next three or four years, according to present plans, and it will enable the company to double its present effective capacity.

Cordoba is another city in Argentina whose population is increasing with a great rapidity, and the Cordoba Light, Power and Traction Company, Limited, is engaged on important development works. The original concession for the use of the waterpower of the River Primero would expire in 1912, but this has now been replaced by one extending to 1948. To supplement the existing hydroelectric generating station during the periods of heavy load or shortage of water, a steam plant of 900 horsepower has been installed, and a further 1,000 horsepower from England will have arrived there by the time these lines appear in print. It has become urgently necessary to develop a further section of the river. The English company has acquired more holdings in the American company, so that it now holds ninety per cent of its capital stock, and important electric tramway interests have also been negotiated. J. G. White and Company are now preparing designs and specifications for the new hydraulic installation. Until the completion of this new plant, the 1,000-horsepower steam plant now being added, and a further 800 horsepower which is on order, will endeavor to keep pace with the demand. Tramway construction operations, in extension of the few miles opened last August, are proceeding.

Electrical engineers have had their attention turned back to discussions and experiments of fifteen years ago by the publication, before a Glasgow engineering society, of a few particulars of the Reid-Ramsay steam-turbine electric locomotive, which is now in course of construction at the works of the North British Locomotive Company. The Heilmann steam-electric locomotive of 1894 will be remembered by many. Hugh Reid, the managing director of the company named, says that the present locomotive is a new development of the Heilmann idea, only on a different and more practical basis. As cost of conversion is the great obstacle in the way of electrifying many railroads, the merit of any independent self-generating unit that would operate over existing railway systems without necessitating any electrical equipment of the railways themselves, was obvious. In the Reid-Ramsay locomotive an ordinary locomotive boiler fitted with a superheater carries coal and water supplies in bunkers and tanks on both sides. Steam is led to an impulse turbine (3,000 revolutions per minute) to which is directly coupled a continuous-current variable-voltage generator. The dynamo supplies energy at 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive. The exhaust steam from the turbine passes into an ejector condenser and to the hot well, from whence it is returned to the boiler by a feed pump, and the supply of water carried in the tanks is actually circulating water for condensation purposes. It is circulated by a small centrifugal pump driven by auxiliary steam turbines alongside the main turbine and dynamo. The cooler is in front of the locomotive. The small switchboard and instruments, the controller for grouping the four motors in series, series-parallel, and parallel, according to the drawbar pull to be exerted, and the regulator for controlling the voltage in the electrical circuit, and consequently the train speed, are all placed within easy reach on the driver's platform. The strong underframe is carried upon two eight-wheeled compound bogies. Each bogie carries two of the four motors. Mr. Reid says that the engine is intended for express passenger main line work, and he hopes to obtain actual working performance data for comparison with reciprocating steam locomotives.

Before the Institution of Mechanical Engineers in London, on November 19, Herbert A. Humphrey, in a paper on "An Internal Combustion Pump, and Other Applications of a New Principle," described the construction of a pump of great simplicity and strength of construction, in which the explosive force is exerted directly upon the water, and in which no rotating flywheel, solid piston, connecting rod, crank, bearings, or glands of any sort are required. He said that as the result of his experiments, several very successful types of pumps had been devised and set to work on a scale sufficiently large to demonstrate their utility and economy. By allowing the movements of liquid to control the pump, and by causing the mass of liquid moved to be sufficiently large, the velocities are never excessive. The mass of water forms a pendulum which swings between the high and low level, and by its movement alone, serves to draw in fresh water, to exhaust the burnt products, to draw in a fresh combustible charge, and to compress the charge previous to ignition. Curves were given to indicate the possibility that internal-combustion pumps might be substituted for gas engines in central electric-power stations. If the water pumped is passed through an ordinary water turbine driving an elec-

tric generator, and the water is then returned to the pump to be used over and over again, "we arrive at a gas-power electric system with the water forming a hydraulic coupling." The author looked into future possibilities to see what a central station on the new lines might be like. In the diagram a section of such a station is shown, so as to exhibit one unit of plant, the other units being arranged side by side. The pump discharges through the valve box situated in the suction tank, the latter also serving as an insolating tank.

The discharge pipe conveys the water into a large air-vessel placed outside the building. This air vessel is connected with other similar air vessels by a common air pipe at the top, which maintains the air pressure the same in all the vessels, and a common water main at the bottom. The water is fed to the turbine by a pipe, and the turbine discharges into a longitudinal canal which has a connection to each of the suction tanks. The turbine is direct-coupled to the electric generator, and the current may be taken to the switchboard, which is conveniently placed for overlooking the machinery. The necessary isolating valves appear in the diagram, and it will be seen that the working parts of the pump, as also the turbine and generator, are so situated as to be supervised from a common platform. The gas main runs longitudinally outside the building. The absence of noise and shock and exceedingly low cost of upkeep were named as the advantages of the arrangement, and Mr. Humphrey further remarked as follows: "In gas-engine stations using cheap producer gas or blast-furnace gas, the cost of lubricants and stores frequently exceeds the cost of the fuel, but in the present instance there is practically no lubrication required, and the author has worked one of his pumps for a week at a time with absolutely no lubrication whatever. Of course, one has to face the loss due to the conversion of the waterpower into mechanical energy, but the efficiency of a well-designed turbine is not less than eighty per cent at full load, and there is no need to work any of the pumps at less than full load. The ease with which they can be started and stopped from the switchboard gives the electrician complete control of his station, and the ability to start up one or more pumps at a moment's notice. In fact, even this arrangement can be simplified, because the governing of the pumps can be so arranged that a steady pressure is kept on the air vessels irrespective of the demands, and a slight rise in this pressure may automatically cut out one pump and its attached dynamo after another, and restart them again as the pressure falls. Based on the efficiencies so far obtained, a Board of Trade unit can be generated for two pounds of anthracite coal, and with the large units of plant required in central stations this figure should be much reduced. Even if the fuel economy should not prove to be higher in such a station, yet its other advantages may more than compensate for this defect. . . . If the contour of the district is such as to permit the construction of a high-level reservoir of considerable capacity in proximity to the pump house, water can be pumped into this reservoir and be drawn upon as required. This would enable the pumps to work steadily day and night on a 100 per cent load factor, and would reduce the quantity of plant, in so far as the gas producers and pumps are concerned, to the minimum possible." It was stated that Allen Nicholls, who had had charge of the electrical ignition devices, had produced a sparking plug which was absolutely reliable when washed by water at each stroke.

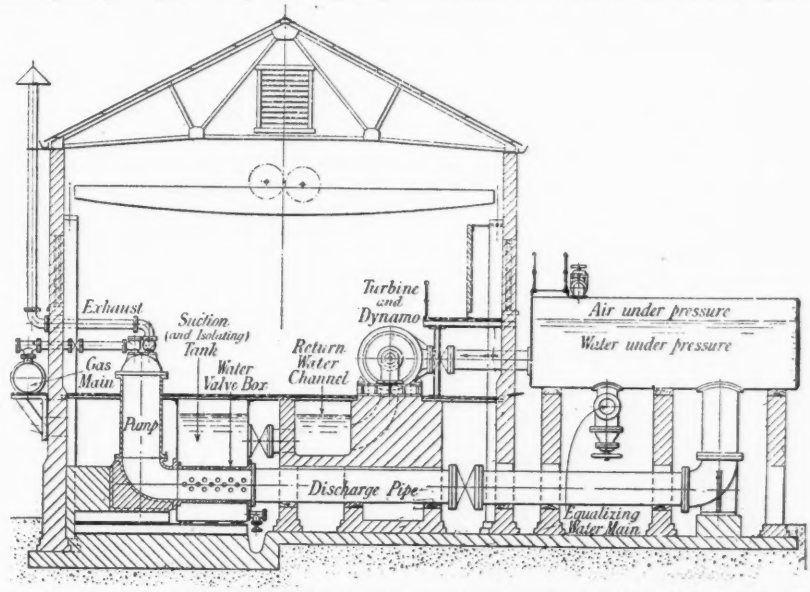


DIAGRAM OF SUGGESTED CENTRAL STATION, SHOWING HYDRAULIC COUPLING BETWEEN THE GAS POWER AND ELECTRIC POWER.

The inaugural address of the president and local section chairmen of the Institution of Electrical Engineers have now been delivered. Dr. Gisbert Kapp, the president, in taking the chair at the first London meeting for the session, reviewed the state of electrical engineering, drawing attention to a few of the novel features in design of electrical apparatus, and to a few among the many applications of electricity to industrial processes. The enormous field of useful work lying open to the electrical engineer in connection with the industries was referred to by the president, and the reasons why British electrical engineering is not as prosperous as it might be were inquired into. A number of appendices to Doctor Kapp's address showed in useful form the particulars of the various large power distribution companies, their systems of generation, transmission, and distribution, the greatest distances to which they deliver power, and the nature of the industries to be served in their respective districts. Other appendices related to electrically driven rolling mills in English works, and electrically driven winding engines in some English pits.

On the same night a marble bust of a renowned former president, the late Dr. John Hopkinson, was presented to the Institution on behalf of Mrs. Hopkinson.

The address delivered at the Birmingham Section by R. K. Morcom was one of the best investigations that has yet been made regarding the trials through which British electrical industry has been passing in recent years.

Albert H. Bridge.

London, November 27, 1909.

The Melville and Macalpine Reduction Gear.

In spite of the present development of the marine steam turbine it is nevertheless true that the greatest possible advantage is not made of this prime mover in present-day marine practice. The reason of this lies in the fact that the steam turbine operates at its best efficiency only when running at a high speed, whereas the propeller that it has to drive must be operated at a much lower speed in order to obtain the best results. The consequence is that neither of these component units can be worked at its maximum efficiency, for a compromise speed, too low for the one and too high for the other, must be employed, inasmuch as hitherto it has been impossible to employ a speed-reduction gear which is capable of withstanding the enormous stresses to which it must be subjected in the transmission of a great horsepower and at the same time have of itself an efficiency which would not more than offset its other advantages.

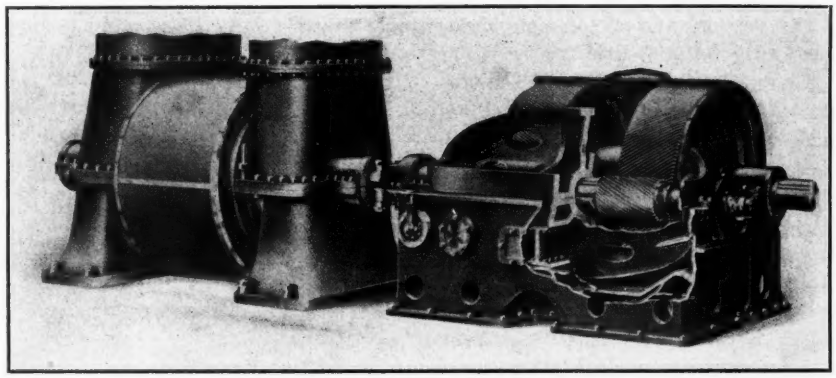
A solution of this problem has now been offered through the instrumentality of George Westinghouse, the head of the great mechanical and electrical companies that bear his name.

At Mr. Westinghouse's suggestion, and with the immense resources of the Westinghouse works at their disposal, Rear-Admiral George W. Melville, ex-Engineer in Chief of the United States Navy, and John H. Macalpine, a well-known consulting engineer, have invented and constructed a speed-reduction gear by which it is possible to couple together the turbine and propeller shafts so that each may revolve at its critical speed of maximum efficiency. This gear has been tested by a specially designed 6,000-horsepower hydraulic absorption dynamometer at the Westinghouse works for a period of forty hours of continuous running, and the remarkable efficiency of over 98.5 per cent was attained, this while the driving turbine was running at 1,500 revolutions a minute with a reduction to 300 revolutions at the dynamometer end (representing the ship's propeller).

When this performance is compared with a statement made by President Denny in his inaugural address to the Institution of Marine Engineers in Great Britain on October 5, 1908, it will be apparent that a revolution in the design of steamship machinery is imminent. Mr. Denny said in this address: "It has frequently been suggested that if some inspired engineer would evolve a system of gearing that would be lasting and reliable, not too noisy, and would not absorb in friction more than, say, ten per cent of the power, turbine engines would be capable of application to any speed of vessel, and to any size of propeller; you would then have a high-speed turbine and a low-speed propeller, which is the ideal condition for marine propulsion."

The Melville and Macalpine reduction gear absorbs but one-seventh of the power proposed by Mr. Denny as a loss reconcilable with efficient working conditions.

The accompanying illustration of the reduction gear connected to a Westinghouse turbine, gives a good idea of the device, part of the frame and casing being broken away in the view to expose the interior.



MELVILLE AND MACALPINE REDUCTION GEAR CONNECTED TO A WESTINGHOUSE TURBINE.

The teeth of the gears are helical to permit of noiseless running, and end thrust is eliminated by reversing the pitch of the gear wheels of the opposite halves of the mechanism. In order to reduce pressure on the teeth to the minimum required by good engineering practice, and at the same time keep down the size of the teeth to insure the best possible running conditions, the width of the gears had to be made very large, as can be seen from the illustration. Wear on the teeth is equalized by introducing an additional cog, technically called a "hunting cog," in each of the larger gears; that is, one more cog than is necessary for an absolutely integral speed reduction is used, which, while hardly affecting the velocity rates to an appreciable degree, insures that each cog of one wheel will come in contact at definitely recurring intervals with each and every cog of the gearing wheel.

The smaller gear or pinion is mounted in what the inventors call a "floating frame," and this is the real feature of the invention, that makes possible the remarkable efficiency and durability attained in the test.

This floating frame is a heavy steel casting supported only at a single point midway between the bearings. The support is flexible so that the frame is free to oscillate in a vertical plane passing through the axis of the pinion, but is held securely against motion in any other direction. Furthermore, the pinion is free to move endwise in its bearings. Any tendency of the teeth to bear harder at one end of the gear than the other would tend to unbalance the respective end thrusts due to the right and left hand spirals of the teeth; but as the pinion cannot present any resistance to unbalanced end thrust, it constantly adjusts itself in the direction of its axis to the position corresponding to equilibrium between the opposing forces. This means that the tooth contact pressures are always automatically equalized.

Mr. Westinghouse states in a letter over his own signature, that the machinery described and illustrated herewith, "while costing less and weighing only about one-half as much as the turbine machinery successfully used on British vessels, will effect not only a great economy in fuel but will also permit of much higher speeds in cases of emergencies. Were the United States Government," he says, "to apply this type of marine turbine to the large 26,000-ton battleships for which contracts have only just been let, we could have the fastest battleships yet projected by any nation."

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

A RATIONAL METHOD OF INSTALLING SERVICE METERS.

BY H. W. YOUNG.

The average meter installation by central-station managements represents one of the strange inconsistencies of human nature, as frequently the same manager who permits an admittedly poor system of meter installation to exist will prove to be most insistent upon good power-house design and high station economies.

The present loose methods of meter installation are to a certain extent an outgrowth of the early days when wiring was poorly put in and scant attention paid to permanent work. While the wiring practices of the past have been largely eliminated the fact remains that meters which are absolutely under the control of the lighting company are frequently installed in a primitive manner.

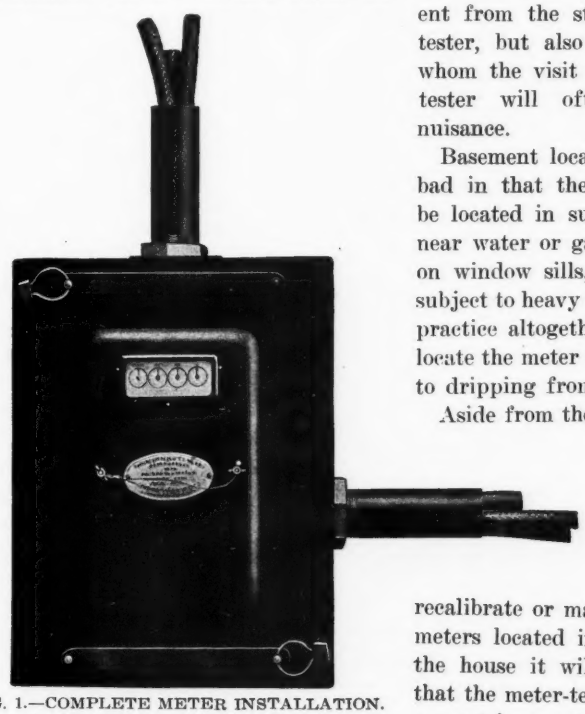


FIG. 1.—COMPLETE METER INSTALLATION.

In some cases the contractor is obliged to place the meter boards in a more or less inconvenient place, or to leave the loops in such a condition that all the meters can be easily installed. This practice is good as far as it goes, but a location which from a contractor's standpoint may be a convenient place to install the meter, is frequently most inconvenient from the standpoint of the central station or consumer. For instance, it is not an uncommon practice to find meters installed in garrets, back under low partitions, in bathrooms, in dark halls, behind the refrigerator, or other equally inaccessible places. It will readily be appreciated that such locations as cited are not only inconvenient from the standpoint of the meter tester, but also to the householder to whom the visit of the meter reader or tester will often prove a positive nuisance.

Basement locations are often equally bad in that the meter will frequently be located in such places as coal bins, near water or gas pipes, near furnaces, on window sills, or on light partitions subject to heavy vibration. Another bad practice altogether too common is to so locate the meter that it will be subjected to dripping from leaky water pipes.

Aside from the inconvenience of reading improperly located meters the most serious objection is the difficulty experienced when it becomes necessary to recalibrate or make adjustments. With meters located in any of the rooms of the house it will frequently be found that the meter-tester's visit will come at a most inopportune moment and much time will be lost in awaiting the convenience of the householder, or in preparation for the meter test. The same objection applies to improper basement locations, for if the meter is not conveniently located it will be found that a great deal of time will be wasted in preparing for the test, all of which could be avoided by a better method of installation.

Again, the present methods of meter installation using open main and branch blocks present a constant temptation to unscrupulous persons in that theft of current is very readily accomplished. It is a well-known and admitted fact that central stations, especially in larger cities, are losing a vast amount of revenue through the practice of stealing current.

Central-station managers are therefore fast beginning to realize that the meter is really an important element of the electrical equipment, for if the meters register incorrectly a large percentage of the economy secured in the generating or distributing systems is quickly dissipated by under-registration of the meters. Aside from this phase of the situation it should be remembered that meters form a very considerable part of the plant investment per kilowatt and come within the scope of valuable assets which should be properly taken care of.

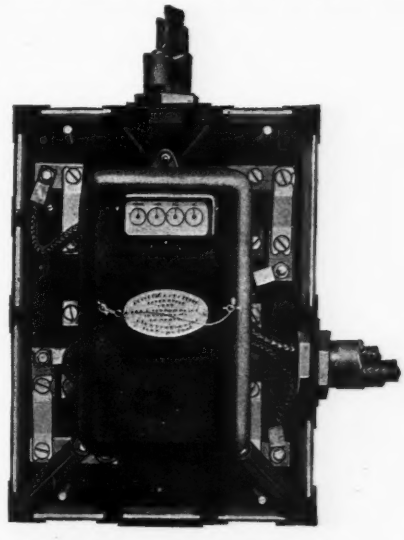
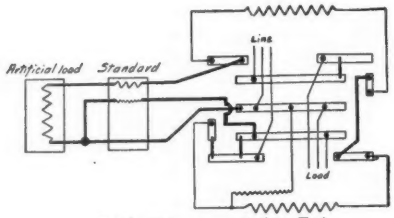


FIG. 2.—METER CONNECTION BOX WITH COVER REMOVED.

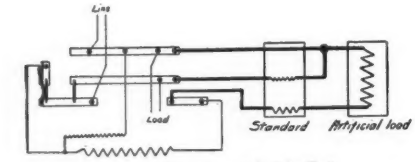
After a careful analysis of the situation extending over a period of years it was decided that central-station managers could be made to realize the importance of proper meter installations. As a result of this decision the installation and testing system described herein was

developed and is now in successful commercial use.

The essential element of this new system is a specially designed meter connection box provided with suitable means for installing meters in such a manner that installations are made safe, accessible and of such a nature that all necessary tests can be quickly and



3 Wire Meter connected for Test.
Current coils of meter being connected in series and in circuit with a Standard and an Artificial Load. Current for test taken from one side of the three wire service.



2 Wire Meter connected for Test.
Standard and Artificial Load connected in circuit with customer's meter

FIG. 3.—TESTING CONNECTIONS.

cheaply made. For small-capacity meters the connection blocks are made of porcelain and in larger capacities they are made of slate and busbar copper.

A method of installing large-capacity meters is shown in Figs. 1 and 2. This type of installation is particularly well-adapted for use on the premises of power consumers where it is advisable to test frequently, owing to the fact that a comparatively slight error in the meter's registration would involve a very considerable monetary loss. This method of connection not only permits of a systematic method of terminal arrangement, but also eliminates the danger of stray field effect upon the measuring coils of the meter.

The terminals on the block to which the meter leads are attached are so arranged that their relative position is always the same irrespective of the direction from which the line and load wires approach the meter. This being the case, the standard meter leads may be directly attached to their proper connection points, thus obviating all confusion and making it possible to trace the direction of the meter loop at a glance. The sides of the box consist of metal stampings which form the corners and conduit entrances, the spaces between these stampings being filled with asbestos lumber strips, that are readily removable, to facilitate connecting up or testing the meter.

The meter itself is supported by studs attached to the slate base in such a manner that it is possible to set up and connect any make or type of meter within the capacity of the block without making any changes other than can be affected by a moment's use of a screwdriver. Metal covers are provided that entirely enclose the meter and connection wires may be sealed in a closed position as shown in Fig. 1. Special covers are provided for different types of meters so that it is possible to replace a meter of one make or size with another by arranging the meter supports and substituting the proper sized meter-cover.

Fig. 2 shows the method of mounting the meter, the connection box cover being removed. The location of fuses, method of conduit entrance and arrangement of asbestos lumber side pieces are clearly shown. Fig. 3 illustrates one of the many methods of conducting tests on heavy-capacity service meters by use of artificial loads and by tracing the connections the circuit through the

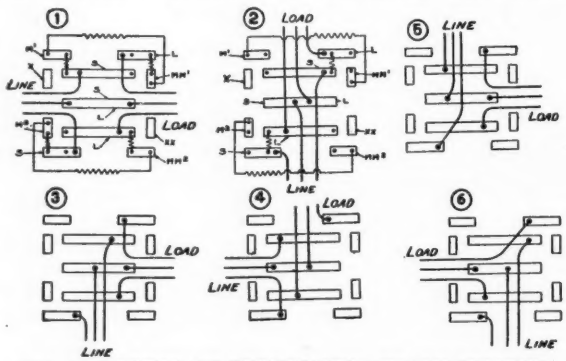


FIG. 4.—METHOD OF TERMINATING HEAVY SERVICES.

series coils of the meter may be readily it is only necessary to insert two fuses across readily accessible points, and then by removing four fuses, entirely disconnect the meter without interrupting the customer's use of current.

Another feature of this meter connection system is that it affords a ready method of terminating heavy-service and load wires. Fig. 4 illustrates six terminal or connection blocks with different arrangement of line and load wires entering and leaving the connection box without crossing. The advantage of this management is obvious when installing meters of different makes having line or load wires entering and leaving from the top, bottom or sides, as the case may be.

New York Interior Wiring Rules.

Commissioner J. H. O'Brien, of the department of water supply, gas and electricity, New York city, has announced the withdrawal, on December 1st, of the interior wiring rules of the city, comprising Classes A and C, included on pages 32 to 42, and 48 to 85 inclusive, of the city's rules and regulations, and the substitution thereof of the interior wiring rules of the National Electrical Code, edition of 1909, as included in Class A—Stations and Dynamo Rooms, and Class C—Inside Work, with the following modifications, which are rendered necessary by local conditions.

8-6. Omit the third paragraph, relating to motor leads.

14-b. Change the first sentence, to read as follows: "If tie wires are used they must have an insulation of the same type as that of the conductors they confine and must be of such a size as to afford ample mechanical security."

21-a and 22-a. Add the following sentence to the end of the first paragraph: "Departure from this rule may be authorized only under special permission in writing, given in advance."

21-d. Omit the fifth paragraph, relating to link fuse rosettes.

24-g. Omit the note under this rule, and add the following sentence as a second sentence of the rule: "Slow-burning insulation may be used only under special permission in writing, given in advance."

24-h. Omit the third paragraph, relating to the neutral of an Edison system.

24-q to u inclusive. Omit these rules, which relate to concealed "knob and tube" work.

24-A-b and 25-d. After "plate" add the words "or other approved device."

25-b. Add to the end of the second paragraph the following sentence: "Departure from this rule may be authorized only under special permission in writing, given in advance."

25-A-b. In the second paragraph omit the first clause and begin the paragraph "where the mechanical strength," etc.

27-b. For the words "'waterproof' sockets" substitute the words "weatherproof sockets especially approved for the location."

31-A. Omit from the general note the words "which is capable of seating at least 400 persons."

31-A-a. Omit the notes under paragraphs 1 and 2 and add the following sentence at the end of paragraph 1: "Departure from this rule may be authorized only under special permission in writing, given in advance."

31-B-l. Insert after the word "wires" the following words: "Connected to open terminal receptacles not enclosed in outlet boxes."

36-c. Omit the words "thoroughly insulated from the ground, or."

SOME REMARKS ON DISTRICT STEAM HEATING.[1]

BY W. J. KLINE.[2]

The development of operating methods has, in a measure, paralleled the advancement of construction details. Mechanical soundness is a vital factor, but without rational business principles in the operation of a district heating system, mediocre results will be obtained.

Boiler room efficiency is a problem too often neglected, or indifferently studied. Here is the source of heat to be distributed whether in live or exhaust steam, and the expenditure of man's best resources will be amply rewarded. With the vast fund of information available, it is a reflection on any operator who only secures fifty per cent of the heat units in coal when he should get sixty per cent, or sixty per cent when he should get seventy per cent, etc. Records, tests and comparisons stop many leaks.

The operation of a combination steam heating plant, one using both exhaust and live steam, presents a further problem in the engine room, which will influence the degree of profit to a considerable extent.

It must be conceded that back pressure on engines increases the amount of steam required to develop a horsepower, but this back pressure has been aptly described as "the most profitable load an engine carries" when the exhaust steam is sold for heating. It will also be conceded that a unit quantity of steam contains a certain quantity of energy, a greater or less proportion of which may be developed according to the construction and efficiency of what might be termed the "transformer."

A third postulate will also be conceded—that there exists in every community a definite demand for heat, varying according to the changes of temperature, etc., and uninfluenced by other necessities, such as water and light.

Since there is a demand for heat, which is distributed from the central station in the form of steam, it follows that there exists a certain amount of mechanical energy in the total quantity of steam demanded for heating. Therefore, an ideal engine room condition would be the development of the greatest amount of energy possible from the steam needed to supply the heating demand, and with the engine which will use the least amount of steam per horsepower against the necessary back pressure. Then when the exhaust steam has been sold for heating, the greatest possible heat efficiency of steam will be realized.

It is not profitable to run two engines under back pressure, when one will supply the exhaust steam needed. Therefore a considerable expense is justified to provide station piping so arranged that the best co-ordination of electric and heating loads possible may be realized. This arrangement is indispensible for the further reason of the fluctuation in the amount of heat required in various months, which ranges from five to six per cent of the season's demand in the warmer to several times greater in the coldest months.

Each individual case will vary somewhat, depending upon station equipment and heat demand, but in the main, a scheme of operation can be worked out in any plant, which will assist toward economy of operation without much expense.

Aside from the generating station and a properly constructed underground distributing system, the district steam heating problem becomes largely one of dealing with the individual consumer, and since steam heating companies seldom have an interruption of service, the commercial feature is one of the principal factors to be considered.

The invisibility of heat is its most important distinguishing characteristic. Heat may therefore be used and wasted without being particularly noticed by the consumer except so far as his comfort is concerned. This furnishes the key to the problem, which is measured service.

About the first method of selling heat was that of charging a fixed amount for the heating season, equal to the average coal bill. In another method a fixed sum per square foot radiation installed was charged, which was manifestly unfair, since the ratio of heating surface to space is seldom alike for buildings of the same size, type of construction, glass and wall exposure, etc.

Probably the most equitable of the flat-rate methods is that of a fixed charge per unit of space heated, but since the quantity of heat consumed is influenced by the construction and use of the building, temperament of the individual, etc., even this method cannot fail to work injustice in a majority of cases. Tabulated records show a variation of over 100 per cent in heat used per unit of space in the same cities.

The velocity or live-steam meter was the first forward step in the selling of the heat of steam, and many of these meters are in use today. Their moral effect has been helpful to plants using them, besides furnishing a fairly accurate record of consumption under the proper conditions. Pressure and volume variations which affect the calibration of the meter, have been the principal handicaps of this style of meter.

The need of an accurate device to measure the quantity of heat consumed, resulted in the invention of the condensation meter and its subsequent development. The scientific principle upon which it is based is too well known to require discussion, but it should be noted that its accuracy is practically uninfluenced by variations of pressure of the steam entering a building, and for the following reasons: Based on the temperature of steam at zero pressure gauge, the increase in temperature at twenty-five pounds pressure is about twenty-four degrees Fahrenheit, but the total heat of steam at twenty-five pounds pressure is less than one and one-half times greater than the total heat at zero pressure. Therefore, for all practical purposes, each customer receives an equal heat value for each pound of steam condensed. Reference to standard tables of the properties of steam will show the exact variations in quantities.

The condensation meter is now in general use by district steam heating companies and no company will realize its proper success unless it is adopted as a medium for determining charges.

A proper rate is of vital importance to a heating company and should fulfill two conditions: (1) It should allow the company a fair profit over manufacturing costs. (2) It should not be burdensome or prohibitive to the consumer, but it should be high enough to discourage extravagance.

Manufacturing costs are made up of two items, generating and fixed charges.

Generating charges vary according to the cost of coal, water and labor, and the evaporative efficiency of the fuel and may average from twenty to thirty per cent per 1,000 pounds of steam manufactured, according to locality.

Fixed charges are based on salaries,

[1] Abstract of a paper presented at the first annual convention of The National District Heating Association, Columbus, Ohio, November 11, 1909.

[2] Of the American District Steam Company, Lockport, N. Y.

office expenses, investment, etc., and the amount per 1,000 pounds will vary inversely as the total quantity manufactured during the season. The sum of the foregoing items plus a fair profit should determine the net average rate charged.

For a particular community local conditions should be taken into account in determining what the company must charge, and what the customer can afford to pay. In this latter connection it may be said that a customer can afford to pay, per 1,000 pounds of steam, at least one-tenth of the local cost per ton of anthracite coal, and for this reason: Fuel burned in small quantities will not produce a high evaporative efficiency, and therefore, on the basis of five to one, 10,000 pounds of steam will be made from a ton of coal, which, I believe, is conservative. This fundamental handicap in individual plants has a further tendency to compel the average individual toward insufficient heating or at least to regulate the supply more nearly to necessity, which he often fails to do when using heat from a district system, unless the rate charged is high enough to furnish a motive for economy. Heating companies are often confronted with the statement that their service costs more than the expense when the individual "used to do it himself." The statement would be quite harmless, if qualified by the fact that the customer has used a proportionally greater amount of heat.

A sliding scale of charges varying according to quantities consumed seems to be the most desirable, for the larger the consumer, the proportionally less his generating expense, and as a matter of business the operating company can afford to take a less profit per 1,000 pounds when large quantities of steam are sold.

Rates should always be based on the manufacturing cost of live steam independent of the benefits a company derive through utilizing its exhaust steam. It is true that the profits of exhaust heating are larger than of strictly live-steam heating, but the economic principle of demand for heat, and its commercial value, remain unchanged, and the contingency of furnishing live steam should be anticipated.

An operating company should uphold a proper rate and educate the individuals to economy, rather than make concessions in cases of excessive consumption due to carelessness or to fundamental causes, for example, poor construction of building, business of occupant, or mechanical defects of the piping system.

Every well conducted heating system should have a system of accurate records of all departments of the business arranged in convenient form for comparison. Without such records and unless used when kept, progress will remain largely a matter of chance.

Among the items of station records will be included: Pounds of fuel burned; pounds of water evaporated; average daily temperature; average daily wind; average daily relative humidity; average temperature of feed water; daily kilowatt output (if combination plant), etc.

Office records will include: Monthly condensation of each customer; an accurate measurement of the space heated; amount of radiating surface; economy coil; size of trap; size of meter, etc.

A graphic representation of some of the information of this character oftentimes reveals facts which might otherwise be overlooked.

The heating business in general has been considered too easy. This is true of selling as well as of operating. Within a short time, a manager said to me, "We never solicit heating business; it comes to us." It seems to me that if the heating business is at all worth while, every possible customer should be secured, for the more space heated per foot of mains installed, the greater the net profit of operation as the fixed charges are spread over a greater volume.

However, such conditions are rapidly passing away. A great deal of information has been compiled, and with standard construction, reliable meters, equitable rates, the success of district steam heating is assured, as has been demonstrated by the many companies now operating.

Electrical Opportunities in Australia.

The Bureau of Manufactures is in receipt of a communication from an Australian organization requesting the names of firms that can supply machinery and appliances for the following: The utilization of water, wind, steam, and the generation of electric power for the manufacture of calcium carbide and metal sheets and foil; also aluminum in bulk and in manufactured form, and appliances for aerial wire transport and ground railways. Further particulars may be obtained by writing to the Bureau of Manufactures, Washington, D. C., quoting File No. 4178.

DEVELOPMENT OF ELECTRICAL UNDERTAKINGS.[1]—II.

BY S. J. WATSON.[2]

There is no doubt that the reciprocating engine has a very high thermal efficiency with moderate steam pressures, and it has been suggested that to obtain the highest possible efficiency from the use of highly superheated high-pressure steam in large units of plant, a combination might be used consisting of a one-stage or two-stage impulse turbine at the high-pressure end, a reciprocating engine for the intermediate pressure, and an exhaust turbine at the vacuum end. Such an arrangement possesses certain theoretical and practical advantages. There is apparently no difficulty in designing impulse machines to run with steam of the highest superheat and pressure, and the superheat and pressure can be very considerably reduced in one or two stages, whereas under similar conditions trouble is likely to arise in the cylinders or valves of reciprocating engines through distortion owing to changes of temperature in providing efficient internal lubrication, or in the suitable maintenance of the steam glands.

At intermediate pressures the reciprocating engine is undoubtedly very economical and satisfactory. The equivalent of the large low-pressure cylinders theoretically required for the reciprocating engine working on high vacuum can be much better provided in a turbine. As two-thirds of such a combination would, however, consist of turbines, there would have to be a very considerable advantage in the economy of the reciprocating engine at the intermediate pressures compared with the corresponding portion of a turbine to warrant the additional cost and complication of such a combination, and as yet no figures are available to show that such a marked improvement would be forthcoming.

So much has been written and said recently concerning large gas engines for power stations that I hesitate to say very much on the matter. The whole question is really one of load factor, and, unfortunately, the load factor of the most public supply undertakings is so low, it is impossible to say or to estimate with any degree of certainty

[1] Chairman's address at opening meeting, Institution of Electrical Engineers, Manchester (Eng.) Section, October 22.
[2] Borough Electrical Engineer, Bury, Eng.
Note.—The English money values have been changed in all cases to approximate American figures.

that the extra cost of the gas engine plant will be counterbalanced by the reduced fuel costs. Inasmuch as the load factor, however, is slowly but surely improving, it is not unlikely that in the near future it will be found economical to install gas engines to deal with at least that portion of the load having the highest load factor.

For a direct-current station situated in a good position for obtaining coal supplies a combination of gas engines as the prime movers with large storage-battery capacity appears to be an excellent arrangement. The higher capital cost of gas engines as compared with steam plant is only warranted when the running load factor is high, and the cost of storage batteries as compared with steam plant only appears advantageous when the output capacity is taken at the one-hour discharge rate. If, therefore, the capital cost of a gas engine with battery station is compared with a steam station without batteries not on the basis of the capacity per kilowatt of generating plant installed, but on the maximum demand it is possible to supply, there is very little difference between the two. Exception has often been taken to comparing the capital cost per kilowatt of batteries at their one-hour rate with generating plant capable of giving the rated output continuously for twenty-four hours because the one is strictly speaking unproductive, while the other is productive plant, but so long as peak loads are obtained which only necessitate the employment of plant for about one hour per day, the comparison is quite fair, as the additional twenty-three hours capacity of the steam plant is quite useless, and yet has had to be provided and paid for as part of the equipment. The combination, then, of gas engines with batteries would not much exceed in cost the steam plant capable of dealing with the same maximum demand, and as the working load factor of the gas engine would probably reach, if not exceed, sixty per cent, there is little doubt that the fuel costs and the working expenses generally would be lower than the steam station.

Before leaving the subject of gas engines, it may be as well to note, in passing, that the coming of the gas turbine still seems a long way off. In conversation with a gas engine manufacturer a short time ago, I was assured that gas turbines can be designed; they cannot, however, be constructed, because at the present time there is not a metal on the market suitable to meet the difficult conditions in regard to high temperatures and high pressures under which turbines must work successfully when internal combustion is employed.

Power-station engineers are evidently appreciating the many advantages incident to the use of storage batteries on a comprehensive scale. The load can be leveled out so as to improve the load factor of the main plant, the supply pressure can be kept constant even with sudden and violent changes of load and greater security is provided against a total shutdown. During the last few years batteries many sizes larger than previously contemplated have been put into use, and the ideal conditions of supply of our gas and water undertakings in regard to storage may even be realized in the near future.

Much less attention is given nowadays to the old idea of grading the size of plant so that whatever the demand it should be possible to work with approximately full load on each set. The best all-round results are now obtained from large plants, although they do sometimes have to be worked on light loads. The subdivision of plant reminds me that the original contract for one of our supply undertakings provided for the erection of two thirty-five kilowatt and eight sixty-six kilowatt sets, and before they were all set to work it was decided to sell two of the sixty-six kilowatt sets and obtain one or more of 250 kilowatt size, which in turn have since been superseded by plants of still larger capacity. To a less extent, perhaps, the same course has already been, or will eventually have to be, taken by all undertakings, and for this reason, if for no other, those responsible for the management should use every opportunity to provide funds, whether under the heading of reserve or depreciation, to enable the value of such obsolescent plant to be entirely written off from time to time, so that the net capital expenditure shall only represent the value of the plant capable of being usefully and economically employed under modern conditions. *(To be continued.)*

The Cunard liner Caronia has been equipped with what is claimed to be the most powerful wireless apparatus on any steamship afloat. The radius is 1,200 miles.

Vacuum Lightning Arrester for Telegraph and Telephone Lines.

The toothed-plate lightning arresters generally employed for telegraph and telephone lines, while efficacious in the case of atmospheric discharges, are not sensitive enough to protect apparatus and cables, if the circuit contains any, against the effects of static discharges which may take place in the lines. By means of the vacuum lightning arrester it is possible to insure the conduction to the ground of all charges having a tension of 300 volts and over. For this reason the arrester is particularly useful in protecting two-wire circuits, in which the formation of static charges is generally pronounced. The device consists of a vacuum tube containing the toothed electrodes. The rarefaction of the air facilitates the passage of the discharges, and the electrodes are placed at a sufficient distance to insure good working. As this lightning arrester is protected from humidity and dust, its operation is more reliable than that of the ordinary instruments. The device is constructed in the form of a cartridge, similar to enclosed fuses, and can be connected in the circuit by placing it between flat springs. Pointed lightning arresters and fuses may be used in connection with the same in order to protect it against very violent discharges and excessive currents.—*From L'Electricien (Paris), October 16.*

Manchester (Eng.) Machinery Show for 1910.

The proprietors of *The Engineering Review*, an English technical monthly magazine, are promoting an Engineering and Machinery Exhibition to be held at Manchester, England, from October 14 to November 5, 1910. The head office of the exhibition is at 16 John Dalton Street, Manchester, England. Inquiries may also be directed to The Exhibition Department, *The Engineering Review*, 104 High Holborn, London, W. C., England.

Electrical Openings in Russia.

Consul-General John H. Snodgrass, of Moscow, Russia, states in a recent report that electrical engineers have chances to exploit their ability in the Baku District, as electrical power is being instituted in the immense oil fields of that district. Oil-well supplies, such as casing, drilling tools, rig and engineering machinery and irrigation outfits are in demand.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE NEW DOWN TOWN STREET-LIGHTING SYSTEM OF ST. LOUIS.

BY JOHN E. TIEDEMAN[1].

Before the beginning of the new year, St. Louis will have completed and in operation what the writer believes to be the most extensive, most up-to-date, and most effective street-lighting system of any American city.

The work of arousing sentiment in favor of a new lighting system in the business district of St. Louis and carrying the project to successful completion was placed in the hands of the officers of a voluntary organization composed of merchants and property owners within the district and known as the Down Town Lighting Association.

It had been realized by the merchants and property owners that a new lighting system was badly needed in the business district, and it was finally agreed that some steps should be taken looking to the improvement of conditions.

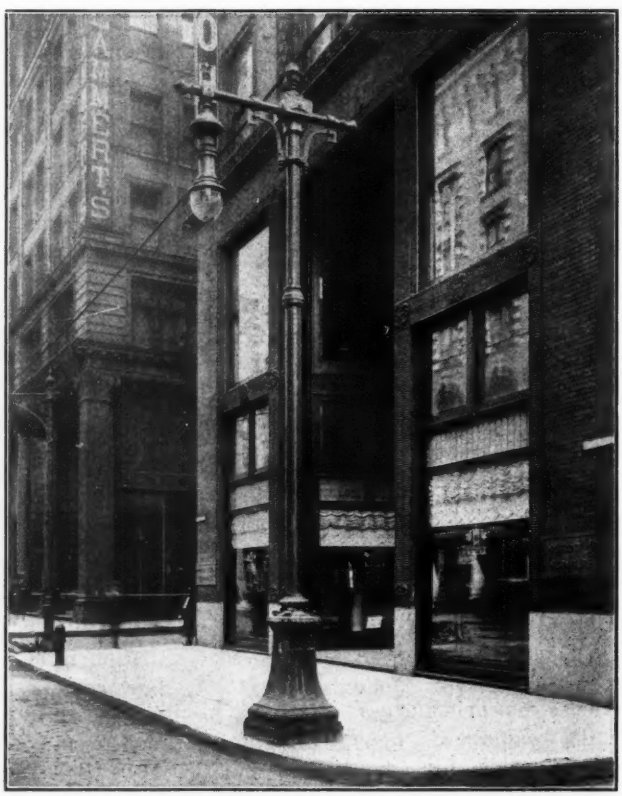
The new organization began work immediately after the beginning of the present year. Committees were appointed, to which were delegated the duties of making a thorough investigation of all existing forms of street illumination, and of devising the proper system adapted to conditions in St. Louis.

After more than eight months of labor, it was decided to install an improved form of arc-lamp lighting, and by process of elimination the new General Electric magnetite arc lamp was fixed upon as the unit of illumination.

This having been established, a committee was appointed to design a suitable lamp standard which could be manufactured and erected at moderate cost, and which would eliminate the unsightly service loops which had heretofore been a feature of the arc-lamp standards. The new lamp standard called for the fixation of the lamp.

These points having been settled, the entire plans were laid before the Board of Public Improvements of the City of St. Louis for its approval and adoption, so that the maintenance charge would be paid by the city under its street-lighting contracts with the Union Electric Light and Power Company. The plans were also placed before the executive committee of the Union Electric Light and Power Company, since it was to undertake the installation.

The association made a contract with

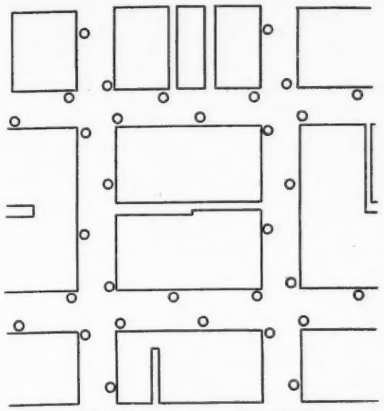


TYPE OF SINGLE-LAMP STANDARD USED ON ALL STREETS IN ST. LOUIS BUSINESS DISTRICT EXCEPT BROADWAY.

TYPE OF THREE-LAMP STANDARDS USED ON BROADWAY IN ST. LOUIS BUSINESS DISTRICT.

[1] Secretary Down Town Lighting Association, of St. Louis, Mo.

the Union Electric Light and Power Company for the manufacture and installation of the standards at a fixed price for each. The company then contracted with the St. Louis Car Wheel Company for the actual manufacture of the standards. It was found that in this



TYPICAL BLOCK ON BROADWAY, ST. LOUIS, SHOWING PLACING OF THREE-LAMP STANDARDS.

way they could be obtained at the least cost and at the same time the business given to a local foundry. The fact that they were "made in St. Louis" made a "hit" with the newspapers and the contributors to the lighting fund.

As soon as these details were determined upon, the question of cost was taken up, and it was estimated that the new lamp standards could be manufactured and installed on the streets at a district of St. Louis was a popular one.

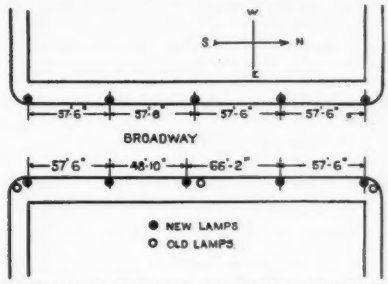
Actual construction work on the new system was begun in August last, and every effort was made by the Union Electric Light and Power Company to have as many streets as possible completed in time for the Centennial Celebration, which began October 4. On that date, enough streets were completed to show what the entire system would be like when completed.

The district illuminated by the new system is bounded by Fourth Street on the east, Twelfth street on the west, Washington Avenue on the north, and Market Street on the south, comprising a total of forty-eight square blocks.

Prior to the installation of the new system there were in this district only 138 arc lamps of the old inclosed type, which had been installed ten years ago. Under the plan of the Down Town Lighting Association there are being installed within this district 427 arc lamps. These are all 6.8-ampere General Electric magnetite arcs. They are placed in a uniform manner on all the streets in the district, with the exception of Broadway. This street was not included in the general lighting scheme, but was left to the City Improvement Association, composed of property owners and merchants on Broadway. The latter association installed on Broadway 240 four-ampere General Electric

the block, so arranged that they are approximately eighty feet between centers. This gives a total of six lamps per block.

On Broadway the lamp standards are designed to carry three four-ampere magnetite lamps; the standards are placed opposite each other on both sides of the street and with approximately sixty-foot centers. This gives a total



TYPICAL BLOCK IN ST. LOUIS BUSINESS DISTRICT SHOWING PLACING OF SINGLE LAMP STANDARDS.

of ten standards, or thirty arc lamps per block. The effect of this illumination is exceedingly brilliant, and has transformed the dark Broadway of old days into the most brilliantly lighted thoroughfare in America, if not in the world.

To indicate the magnitude of the new system, it might be mentioned that in the down town business district there will be installed, when the system is completed, a total of 667 magnetite lamps. There are fourteen streets il-

SIXTH STREET, ST. LOUIS, SOUTH FROM WASHINGTON AVENUE.

BROADWAY, ST. LOUIS, SOUTH FROM WASHINGTON AVENUE.

total cost to the property owners and merchants of $30,000. In order to obtain this sum, the officers of the Lighting Association made an assessment of $1.00 per front foot against all of the property fronting on the streets to be illuminated. The response received from the property owners to the calls for the funds, was more than gratifying, showing that the movement for a new street-lighting system in the business

magnetite lamps, the maintenance of which is paid for by this enterprising association.

The plan of the Down Town Lighting Association calls for four lamps at each street intersection, one on each corner and so arranged that two will line up with those on the north and south streets and two with those on the east and west streets. In addition, there are placed two lamps in the middle of

luminated by the single-lamp standards and one by the triple-lamp standards. In all, there are five miles of streets illuminated by the new system.

The cost to the property owners in the district, outside of Broadway, was $30,000, and the installation on Broadway amounted to $10,000. The city having agreed to maintain all of the lights, excepting those on Broadway, the additional cost to it will be $30,000

per year, to be paid out of the general funds of the city, while on Broadway, where the maintenance is borne by the merchants, the cost is approximately $9,000 per year.

In order to supply the current for the new magnetite lamps, the Union Electric Light and Power Company has installed in its station at Tenth and St. Charles streets, three seventy-five-light, four-ampere General Electric mercury rectifiers and regulators, and seven seventy-five-light, 6.8-ampere rectifiers. In addition to this, it has installed additional generators. The company has also, at its own cost, done all of the work of installation of the new system and has furnished all of the new lamps, the only thing paid for by the property owners in the district being the new ornamental lamp standards. When finally completed the total cost of new equipment and construction, it is estimated by S. B. Way, superintendent of the electrical department of the Union Company, will be fully $100,000, thus making the total cost of the system to the property owners and the company, in the neighborhood of $140,000.

This new system is permanent and will be in charge of Harry S. Sanderson, supervisor of city lighting.

The November Meeting of the New York Electrical Society.

At the 289th meeting of the New York Electrical Society, held on November 30, A. J. Marshall delivered an illustrated lecture on "The Significance of Public Decorative Lighting," using over sixty slides of night views taken in various cities of the country, including many views of the illumination during the Hudson-Fulton celebration. Mr. Marshall described various features of spectacular and display lighting, such as lampposts, arches, building outlining, and the use of searchlights.

Chairman Dickinson in opening the discussion, remarked that the subject was particularly interesting to him as he had just returned from Europe where this feature of the electrical business was notable for its absence.

T. I. Jones, of the Edison Illuminating Company of Brooklyn, stated that the local electrical companies had attempted to obtain contracts for building outline lighting, but owing to the large quantity of current which is required in order to make a satisfactory appearance the amount involved was greater than the merchants were willing to pay. He stated, however, that since the Hudson-Fulton Celebration three contracts have been closed for this kind of work.

During the lecture Mr. Marshall had shown a night photograph of the flaming arc installation in Newark, as described in the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 20 last, and had criticized the lamps on Market Street as being too close to the ground. This brought up the question of the use of flaming arc lamps and Mr. Jones stated that the excavation for the Fourth Avenue subway would be lighted by means of these lamps, and he considered that their use was limited to this kind of work.

H. T. Owens stated that the flaming arc lamp had greater possibilities than given by Mr. Jones, but that they should be used intelligently. He said that the inclined-carbon type of lamps was used in Newark. The first lamps installed in Newark were only seventeen feet above sidewalk level, the later ones were placed twenty-five feet high, whereas in London the same type of lamp was hung thirty-five feet high and also over the center of the roadway.

The flame lamps which were giving the best results in Germany are to be used on the main squares and plazas in the city of New York and these are the Blondel or Alba vertical-carbon lamps taking either ten or twelve amperes. These lamps are not only steadier but they give a white light and the distribution is far superior to that of the inclined-carbon arc. Mr. Owens agreed with the chairman that there were few electrical spectacular displays in Europe, but at Lucerne they poured barrels of burning tar from the top of Mount Pilatus on Saturday nights for the edification of the American tourists.

Franklin Institute.

At the section meeting of the Franklin Institute, announced to be held in Philadelphia on the evening of December 9, Prof. Robert W. Wood, of Johns Hopkins University, Baltimore, was expected to deliver an illustrated lecture on the "Infra-Red and Ultra-Violet, a New Departure in Photography." On account of Professor Wood's well-known researches in this line exceptional interest in this lecture was anticipated.

THE METHODS OF COMPARING OUR VARIOUS SOURCES OF ARTIFICIAL LIGHT.

BY W. E. BARROWS, JR.

The merits of the different sources of artificial illumination in use in this country and throughout the civilized world are based on several important considerations, among which are the following: The candlepower, which may refer to the mean horizontal, the mean hemispherical, or the mean spherical candlepowers as the case may be; the distribution of the light flux, i. e., the intensity of the light in various radial directions; the color of the light; the efficiency of the source; the initial cost of the lamp; its life and cost of maintenance; and its adaptability to the various classes of service. This paper will deal mainly with the problems of determining the photometrical basis of those comparisons involving the values of the candlepower.

The fact that the intensity of light varies inversely as the square of the distance from the source is familiar even to the layman, and the simple methods of photometry are elements of common knowledge. However, the development of new illuminants with color values so radically different and the remarkable progress in illuminating engineering which demands results of greater accuracy, together with the competition in the commercial realm, makes it imperative that photometric results should possess a percentage of accuracy comparable with measurements of the other engineering professions.

The troublesome element in obtaining satisfactory and consistent results in photometry is what is known as the Purkinje or color effect. Without disputing the law of inverse squares it appears that the normal eye can distinguish detail better when the subject is illuminated by a light emitting many green or blue rays than when the light is of a yellow or reddish hue, if the intensity of illumination is low, while the converse is true if the illumination is of greater intensity. An explanation for this phenomenon is that there are in the eye two sets of optical nerves known as the "rods" and the "cones." The cones are the predominating organs when the illumination is intense and they are more sensitive to light of a red or yellow hue, while

if the illumination is of a low order the iris opens up and the sensations are received by the rods which are partial to light of a bluish or greenish hue.

Let us consider the effect of these physiological peculiarities on the results of photometric measurements. Suppose we were to photometer a tungsten lamp consuming 1.25 watts per candle against a carbon-filament lamp as a standard which requires perhaps 3.5 watts per candle. The tungsten filament being at a much higher temperature will give a light much whiter than that of the carbon lamp. In other words there are comparatively more blue rays in tungsten light and more yellow rays in the light from the carbon lamp. If the photometer screen is brightly illuminated, the cones will be the predominating organs and the photometrical setting will favor the carbon-filament lamp, while, on the other hand, if the lamps are at a considerable distance from the screen and the intensity on the screen is consequently low, the setting, because of the Purkinje effect, will favor the tungsten lamp and the results obtained in the two cases may differ by as much as ten or fifteen per cent.

Thus it will be seen that results taken by one observer may not check with those taken by another especially if different apparatus is used in the two cases. Fortunately there is considerable symmetry in the prevailing apparatus for the most accurate photometrical measurements. The photometer bench is usually about three metres in length so that the source of light may be considered as at a point. The standard in most cases is a carbon filament lamp of about sixteen candlepower and the photometric devices most widely used show no appreciable difference in the results, so that measurements of candlepower hitherto performed may not show any great discrepancies. But the life characteristics of tungsten and osmium lamps are far superior to those of the carbon-filament lamp and the color of the light is more desirable for a standard. These advantages indicate an early adoption of one or both of these lamps as a standard and when this occurs conflicting data from different sources are likely to be found. Moreover, more attention is being paid to the illuminating value of a lamp and less to the candlepower values, i. e., to the color and distribution of light relative to producing a pleasing effect and the desired illumination, rather than the mean horizontal or mean spherical candlepowers. The illuminating value includes as an element the color value of light which seem to agree with values obtained by the ordinary photometer and vary in accordance with the Purkinje effect.

Also the type of instrument used for measurements of illumination is of a portable form and far different from the bench and dark room, and the results obtained by means of the former will conform with those calculated from measurements in the dark room only when the candlepower measurements are based on the illuminating value of the light itself.

There are four types of photometrical devices in commercial use in this country and abroad for comparing the candlepower of luminous sources or for measuring illumination. The Bunsen or "grease spot" photometer, also known as the contrast photometer, is the oldest and most simple in construction and principle. It consists in effect of a sheet of paper in which a certain part with its edges sharply defined has been made translucent by an application of paraffine. Light falling on one side of this screen is reflected from the opaque part while part is reflected and part transmitted by the translucent section. Light falling on the other side is reflected or transmitted in the same way. The percentage of light absorbed by the treated and untreated parts are the same. When the illumination is the same on both sides of the screen the amount of light transmitted in both directions through the translucent part is equal and if the lights are of the same colors the treated and untreated portions will appear identical as viewed through the eye piece and the forty-five degree mirrors.

The "comparison of brightness" or Lummer-Brodhun type possesses greater sensibility than the Bunsen. By means of an optical train the two illuminated sides of the screen are viewed in adjacent fields and the photometrical setting consists in judging equality of brightness of the illminated areas.

Another type is known as the flicker photometer and was designed for the purpose of comparing luminous sources emitting different colored lights—to eliminate the possibility of errors due to the Purkinje effect. Its principle consists in presenting to the eye of the observer by means of rotating disks, rotating beveled surfaces or oscillating lenses, areas illuminated first by one source, then by the other in rapid succession. It was claimed that in this way the eye would be worked at its greatest sensitiveness and the photometrical balance would represent the comparative illuminating values of the luminous sources.

Instruments of another type are known as illuminometers. They were designed as a convenient means for measuring illumination and in this way can be used to compare candlepower values as well. They consist in principle upon the distance from a lamp at which a certain size of print can be read, or the proportional part of the light from a source by which it is possible to discern certain details of drawings or print. In other words, the results obtained by the use of these instruments depend entirely upon visual acuity and without doubt represent the true illuminating values of light sources where a low intensity of illumination is desired, but they do not represent the true illuminating value for higher intensities as met in interior lighting.

Experiments with these types of photometrical devices show that the flicker photometer possesses the greatest consistency in respect to obtaining a photometrical balance and that with reasonable care successive readings will check within one per cent. Moreover, candlepower measurements taken throughout a wide range of different intensities upon the screen agree very closely, thus apparently eliminating the Purkinje effect.

The results of tests by Mr. Wild[1] show a discrepancy of six per cent in the results obtained by photometering a tungsten-filament lamp consuming 1.5 watts per candle against a carbon-filament lamp of 4.5 watts per candle as a standard by means of the flicker, Lummer Brodhun, and Bunsen types of photometers. The flicker photometer, of which three different types were used, gave lower values for the tungsten lamp and differed by less than one per cent from each other. The average results obtained from the contrast and from the equality of brightness types compare very favorably with each other, although the different settings varied by several per cent.

These results show the Purkinje ef-

1 *The Electrician*, London, July 16, 1909.

fect and doubtless if the lamps were placed at a greater distance apart so that the intensity of the light at the photometrical device was less the difference between the values obtained by the flicker photometer and those obtained by the other instruments would be still greater.

Without further thought on the subject it would appear that the solution of the problem of comparing luminous sources differing in color would be by means of the flicker photometer. But in this method the eye is not working in its normal condition when determining the photometrical balance and it seems reasonable that results obtained when the eye is working in its normal condition should be of more practical value and represent the merits of the two sources in a way more comparable with their illuminating properties, than if the measurements are made with the eye excited to conditions entirely unnatural.

The results obtained by using the illuminometer show the illuminating value of a luminous source with respect to distinguishing detail and would seem to be the proper instrument for making photometrical measurements since the objects of light is usually for the purpose of distinguishing objects or outlines. But the illuminometer is of low sensibility, the illumination which it measures is of low intensity, and the normal eye soon becomes fatigued and will give different results under different physical conditions.

The Bunsen and the Lummer-Brodhun types remain, with the Purkinje effect for the disturbing element Nevertheless, these devices possess certain advantages. The illumination on the screen may be almost any desired intensity so that the eye may, in its normal condition, compare illuminations made to conform to those met in practice. The screens viewed through the eye piece may have a certain size type so as to obtain a better idea of the illuminating values of the sources. The results of photometrical settings for various intensities on the screen seem to conform with the physiological conceptions of illumination obtained in practice. To make this point clear we will refer to the peculiarity of the human eye referred to at the beginning of this paper, viz., that it can distinguish detail better when the object is illuminated by a white light than when illuminated by a yellow light if the intensity is low. In practice we use light for discerning objects, we see things by contrast in color; dark or black objects are not changed in appearance when viewed by lights of different colors, while light shades are changed in appearance. Thus in a white light colored objects of light shade will appear with their daylight color, but if they are viewed in a yellow light their color will be distorted by the yellow.

This characteristic shows up the light to an advantage and the same thing occurs in the photometer due to the Purkinje effect.

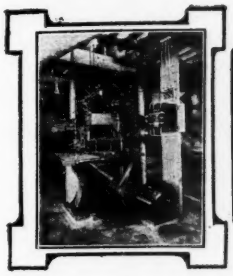
From the above reasoning and from similar reasonings along the same line for higher illumination intensities it would seem that the results obtained by using either the Bunsen or the Lummer-Brodhun photometric device would indicate the true illuminating value of the source although difficulty may be encountered in determining the exact candlepower values of the lamp. Moreover, in portable photometers used for illumination measurements entirely, there is little question but that the above devices give the illuminating values of the source and their greater sensibility and less liability to optical errors, as well as the range of illumination intensities for which the ordinary portable photometer is adapted, make them preferable to the illuminometer.

In the preceding paragraphs are set forth some of the practical complexities of modern photometry. Although the differences may be small in most cases, still there is a broad field for improvement before illumination or candlepower measurements may possess an accuracy or reproducibility comparable with the measurements in the other branches of science.

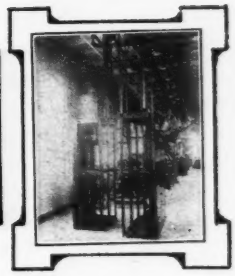
With the photometrical apparatus which is at the present time commercially available for the comparison of the illuminating powers of various sources of light, it is the opinion of the writer, based upon his experience in the dark room and a study of the results obtained by others, that the Lummer-Brodhun photometrical device possesses the greater merit as a means of comparing luminous sources. The Bunsen photometer has been supported by some as the most desirable on the ground that, if the lights from the two sources differ in color, they can be compared against the white field instead of directly with each other as in the Lummer-Brodhun type, but the higher sensibility of the latter appears to more than offset whatever merit there may be in this claim for the Bunsen photometer. It is suggested that the lamps be placed at such a distance from the photometrical device that the intensity of illumination thereon be approximately the same as the illumination intensities obtained from commercial installations and the report of all tests giving the candlepower of a lamp should include the distances at which the lamps are placed from the screen. As an additional means of reducing the Purkinje effect, it is suggested that the commercial photometrist employ the tungsten lamp as a standard and have it calibrated at the Bureau of Standards, for different specific consumptions of energy as, for instance, 1.25, 2.0, 2.5, 3.1 and 3.5 watts per candlepower. In this way one could approximately match the color of any of the incandescent filament lamps, and when operating at 1.25 watts per candle would furnish a far more satisfactory standard with respect to color, for photometering other classes of lamps than the carbon-filament lamp or flame standards which are commonly used.

Determining the Degree of Vacuum of Incandescent Lamps.

The usual method of ascertaining if incandescent lamps are sufficiently evacuated is to subject them to an alternating field of high tension or bring them in contact with the pole of an induction coil. The nature of the luminous phenomena then appearing in the lamps indicates the degree of the vacuum. This method involves danger to the operators, especially when the spark of the induction coil perforates the lamp-being examined. The process of A. Pfeiffer, of Wetzlar, Germany, in which a Tesla field is utilized, does not involve any risks. A small Tesla transformer is enclosed in a box, and one of its poles is connected to the board which carries the entire series of lamps to be examined in one operation. The other pole, consisting of a metallic ring, is attached to an insulating handle and passed over the lamps at a sufficient height to prevent the formation of sparks. The tension is so chosen that even imperfectly vacuumed lamps become luminous. As is well known, the high-frequency Tesla discharges are harmless, and the operators are therefore not exposed to any danger.—*From L'Electricien (Paris), October 30.*



Industrial Power



THE ELECTRIC PROPULSION OF SHIPS.[1]

BY H. J. ORAM.[2]

An electrical drive has already been adopted in some ships of small power where the prime mover is an internal-combustion engine, in order to overcome difficulties in starting, and to avoid complicating these engines with reversing-gear. In one system an electrical drive is adopted for reversing or slow speeds only; at other speeds, though the dynamo and motor are coupled to the engine-shaft, no electricity is generated, and the internal-combustion engine is working directly on the propeller. In this design the capacity of the dynamo and motor is limited to about one-half the power of of the engine in order to save weight. Since the introduction of turbine machinery in warships, proposals to supersede turbines directly coupled to the propeller shafting, by designs where electrical machinery is interposed between the turbines and the propellers, have been made several times.

The system, as proposed, consisted of the employment of economical turbines, at very high revolutions, similar to those in use on land electric-light stations, with a dynamo and motor interposed between the turbine and shaft to reduce the speed of the latter to that which is most suitable from the propeller efficiency point of view. The turbines are always run in one direction, and reversing can be effected by the change of the direction of the current at the motor.

The claims made for this system are that the loss due to the interposition of the dynamo and motor between the turbine and propeller-shaft is more than counterbalanced by the gain due to the more economical steam consumption of high-speed turbines, and that due to a higher propeller efficiency when working at more moderate speeds than is usual in ship turbine machinery.

It is also claimed that the radius of action of the ship will be increased due to an economy when working at low powers, dynamo-machines being shut off altogether, as required, and the remainder worked at, or near, their economical power, and that although the high-speed turbines and electrical machines are together heavier than the direct-coupled turbines this is more than compensated for by the lesser boiler power required, consequent on the higher efficiency of the fast-running turbines and slower-running propellers, so that a complete installation for the same speed of vessel is not only more economical, but no heavier. Further, that there would be an increased economy from working the auxiliary machinery by motors driven from the main generators.

These are the main features of the system; there are various other claims made, but they are not important compared with the preceding.

The actual figures are the subject of considerable doubt and controversy, and would require much time for an adequate examination. I shall only refer generally to some of the important features.

As regards economy at full power, it must be remembered that the claims are based on figures obtained from trials of electric-light stations on shore, and it is somewhat doubtful of the same results will be obtainable when similar units are worked as a battery on board ship with the engines and boilers placed in from five to seven or even more separate watertight compartments.

It appears that the loss which results at the dynamo and motor is not less than twelve per cent, so that not more than eighty-eight per cent of the shaft horsepower given out by the turbine would be available as horsepower at the propeller-shaft

The actual steam consumption in pounds per shaft horsepower for the propelling turbines in the three ships of the Indomitable class is only twelve pounds at full power, and this without superheating. The figures guaranteed for the steam consumption of the electrical combination from experience in short electric-light installations were given in one case worked out in detail as 12.9 pounds per brake horsepower at the propeller shaft without superheat, and 10.9 pounds with 100 degrees superheat, the vacuum being twenty-eight inches. It will be seen, therefore, that in the particular case of the cruisers mentioned there is little margin of superiority at full power available for reduction of boiler power, even allowing for the probable improvement in economy of the electrical installation due to the larger units in these ships.

The claim to increased economy at low powers should be realized, as the generators then in use could be worked nearer their maximum output, but it must be remembered that the efficiency of the motor falls off with reduced powers, but the actual amount is doubtful. This feature of the system is the important one as regards machinery of warships. The claim as regards increased power for going astern is also justified.

As regards increased propeller efficiency, it must be remembered that the efficiency now obtained with the slower-running propellers has been the result of many years' experience. The early turbine propellers had low efficiencies; experience has enabled these to be increased, but they do not yet reach the figures obtained with the slower running reciprocating engines. There is no doubt that as more experience with small fast-running propellers for such large powers as have only been recently introduced is obtained, the efficiency of the latter will be still further improved. In particular cases, such as in the large cruisers of the Invincible class, there has been no falling off in propeller efficiency of the faster running screws

1 Abstracted from the presidential address, entitled "Propelling Machinery by Warships," delivered at the inaugural meeting (November 16, 1909) of the Junior Institution of Engineers, England.

2 Engineer Vice-Admiral, and Engineer-in Chief, of the British Navy.

from efficiencies obtained in the slow-revolution screws of older cruisers.

No doubt a large-diameter propeller assists the maneuvering power of a ship, but the diameter is frequently limited by hull considerations; and electrically driven ships with the same number of propellers, driven slower, would in some cases be limited to practically the same dimensions as in direct-driven installations.

In one design, in which the weights of the turbo-generator and motor were quoted, it was found that the increase of engine-room weights would be considerable, and that the total increase of machinery weights would be about fifteen to twenty per cent. The gain at low powers would require to be very substantial to balance such material increases.

The substitution of electromotors for auxiliary steam-engines would also add to weight, and such auxiliary machinery as steering engines and distilling plant would for the present require to be steam-driven.

The electrical pressure proposed in the various plans has varied from 1,000 volts in the lowest to 2,750 volts in the highest, and these are all very high, from the point of view of safety, for use in the British navy. Also, before any system could be adopted many necessary details would require to be carefully considered, such as freedom from danger of failure due to access of water to the electrical machines or to particular parts of them, and the ventilation of the machines, as considerable heat is generated.

With the interposition of two electrical drives between the turbines and the propeller, in addition to special dynamos as exciters, it is not probable that the wear and tear would be less or that less staff would be required, but rather the reverse.

In the designs submitted to the British Admiralty there has been no gain in the space occupied, but in some cases an increase.

It is essential for warship purposes that the small variations of speed required from the propellers when keeping station in a fleet should be readily obtained, and in this respect the electrical systems which have been proposed to the Admiralty are far from satisfactory. The various firms have only proposed to provide for three electrical speeds—full, half, and quarter—and have suggested that if anything further were required that the speed of the generators should be regulated. This latter would detract from the economy of the system. It is recognized that further attempts are being made to meet this condition, which is absolutely necessary as far as warships are concerned, provision for station keeping or the power of making gradual changes of speed throughout the whole range, both ahead and astern, being essential.

Finally there appears to be considerable doubt as to the efficiencies of the various systems proposed, and the figures on which they are based; but, speaking generally, the conclusion seems to be that the interposition of a dynamo and motor between the engine and its work, involving when on board ship considerable liability to accident and derangement of the electrical machines, in addition to present risks, has disadvantages such that the practicability of the details should be beyond question, and the gain by its adoption must be shown to be substantial before the system could be fitted in any important vessel. This has not, I think, been done at present. We must recognize, however, the skill and ingenuity with which this problem has been dealt with, and any further developments will naturally receive careful consideration, especially the actual results from installations which are about to be fitted on a small scale. The good work done by electrical engineers on board warships at present in respect to auxiliary machinery of all kinds is too well known to need any comment from me, and we should welcome their co-operation as regards the main engines, if the resulting combination is likely to be beneficial.

Increasing Farm Production by Electricity.

In his presidential address to the Institution of Electrical Engineers, in London, England, on November 11 last, Dr. Gisbert Kapp made the following interesting observations on the application of electricity in stimulating plant growth:

"The discovery that electrification of the atmosphere immediately above the plant stimulates in certain cases its growth, is already thirty years old, but only recently has this idea been practically developed—first by Professor Lemström in Sweden, and more recently still by Sir Oliver Lodge, in collaboration with J. E. Newman and R. Bomford, on an experimental farm at Bitton, Gloucestershire, England, and on a farm of about forty acres at Evesham, near Birmingham, and at other places.

"A network of galvanized iron wires is stretched over the field to be treated and suspended eighteen feet from the ground from wooden posts and oil insulators. The posts are placed seventy yards apart, so that about one post per acre is required. The network consists of No. 11 S. W. G. wire placed over the posts in parallel rows 100 yards apart, and No. 20 S. W. G. wire cross-connecting the stouter wires every ten yards. The attachment of the latter to the insulators is not direct, but by means of short links and tension insulators to reduce the electrical stress on the insulator itself.

"The network is positively electrified to from 60,000 to 100,000 volts by means of an induction-coil mercury gas break and Lodge rectifying vacuum valves. The induction coil is worked on the primary side by continuous current obtained from an ordinary dynamo. Lionel Lodge, who is the electrical expert for the various installations, informs me that there is no difficulty in keeping the potential in the network up to the figures given except in misty weather or during rain, when it may fall as low as 200,000 volts; also that the amount of primary power required per acre is very small, namely, from ten to twenty watts.

"The installation is run for five or six months during eight to ten hours each day, and the total expenditure of energy is only about twenty Board-of-Trade units per annum per acre. Under this treatment the increase in the yield per acre is about thirty per cent, but under certain conditions it may be even more. The system is in use on several farms in England, on six farms in Germany, and on one farm in Holland."

Electric Distillation of Turpentine.

Replying to a Philadelphia inquiry requesting more specific information in regard to the electrical distillation of turpentine than was contained in a recent consular report of his, Consul-General George N. West, of Vancouver, B. C., states that specific questions submitted to an electric turpentine company there elicited the following:

"The number of gallons that we have obtained from selected mill refuse has averaged six to eight per cord treated. We have, however, secured a much larger return from wood obtained from other sources, such as very resinous woods, that are not fit for mercantile lumber—much of the Douglas fir grown in this Province is cut leaving a stumpage of six to ten or more feet on account of the base of tree being very resinous. Then, too, trees growing at higher altitudes or those that have been wind twisted have very resinous bases; in fact, are unfit for mercantile use as lumber.

"Our turpentine has been pronounced by leading authorities in the world as chemically pure and is superior to the article generally sold, which we have found by analysis to be largely adulterated.

"We estimate the cost of erecting a mill at $1,500 per cord to be treated, after making liberal allowances for contingencies. We estimate that it would take twelve men to operate a ten-cord mill, consisting of four North Americans and eight Orientals. The pay of the former labor averages from $2 to $3 per day and the Oriental about twenty cents per hour. At present there is only one mill in operation in the world under our methods.

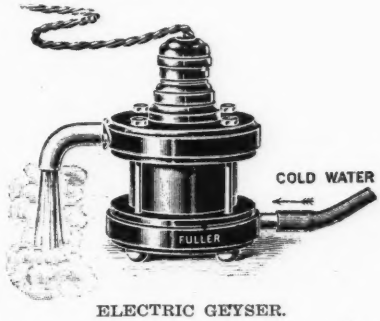
"The present wholesale price of turpentine in Vancouver is $8.10 per cask, but consumers are willing and anxious to pay us a little more than the market price. The by-products, tar, oil, rosin, pitch, and charcoal, all find a ready market, the rosin especially being in great demand for use in the manufacturer of cheap soap."

Three-Phase Motors with Speed Control.

At a recent meeting of the Glasgow (Scot.) University Engineering Society, Parker Haigh read a paper on "Three-Phase Motors with Speed Control," in which he stated that motors with pole-changing types of windings possessed marked advantages over other types of motors when variable speed was desired. A 100-horsepower motor, he said, used as an ordinary single-speed motor, gave eighty-five horsepower when used as a two-speed motor with the same upper speed, this with an efficiency of over ninety per cent, as against a forty-five per cent efficiency for the single-speed motor slowed down to half-speed by the use of resistances.

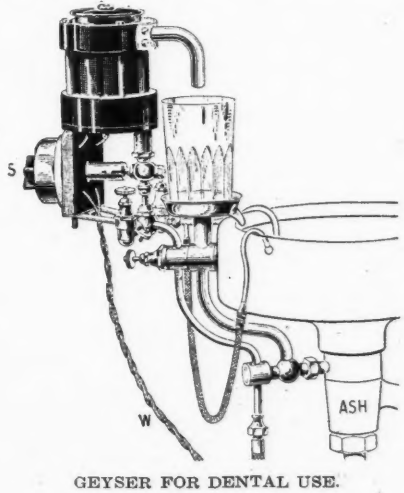
Electric Geysers.

The electric geyser shown in the accompanying illustrations works on an entirely different principle from the various electric water-heating devices now in use. The electric geyser is attached to an ordinary water tap by a rubber hose and the cold water entering the geyser through this inlet pipe passes through a series of chambers which are in direct connection with the electric supply.



ELECTRIC GEYSER.

The water instantly becomes heated and issues in a hot stream from the discharge pipe of the geyser, the time elapsing between the turning on of the tap and the flow of hot water through the geyser being only a few seconds. It is stated that there are no wires or resistances employed in this electric geyser and the apparatus is practically proof against short-circuit. The small geyser is especially adapted for use in



GEYSER FOR DENTAL USE.

the bed chamber or for the dental fountain. A supply of one pint of hot water per minute takes one kilowatt of electricity per hour. The geyser is designed for alternating or direct-current of 100 volts or 200 volts.

The dental electric geyser is four inches deep and three and one-half inches in diameter, the total height from the bottom of the switchplate to the top being seven inches. The body of the geyser is made of hard rubber, and the supply of water may be regulated by means of the tap to any temperature up to the boiling point. In the 100-volt geyser there are a larger number of platinum plates used than in the 200-volt geyser and they are placed closer together, and for this reason the cost of the lower voltage is greater.

This electric geyser is of English design and is being adopted to a considerable extent in British countries.

Electric Smelting in Sweden.

A resent English report states that the Jernkontoret, a national union of Swedish iron works, has decided to make a commercial experiment in the manufacture of pig iron by an electrical process.

The new works will be located at Trollhatten, at a cost of about $125,000. The rights of the process to be employed are owned by the Elektrometall Company, of Ludvika, and was devised by Messrs. Gronvall, Lindblad, and Stalhane, well-known Swedish engineers.

The electric "shaft furnace" has a total height of about twenty-five feet, the height of the shaft itself being eighteen feet. The melting chamber containing the electrodes is about seven feet high, and the furnace attains its maximum diameter at this point. It is the isolation of the descending charge from the lining at the point the electrode enters the furnace that is said to constitute the particular economic advantage of the construction, since it prevents the destruction of the lining.

A recent experiment showed that there had been produced during 903 hours' running twenty-eight tons of iron containing from 0.95 to 3.09 per cent of carbon. In the manufacture there were used the following: Ore, 422 tons; lime, 24 tons; coke, 41 tons; charcoal, 58 tons; electrodes, 6.5 tons, and the current consumed was 891,623 kilowatt-hours.

Electric Pumps for London Docks.

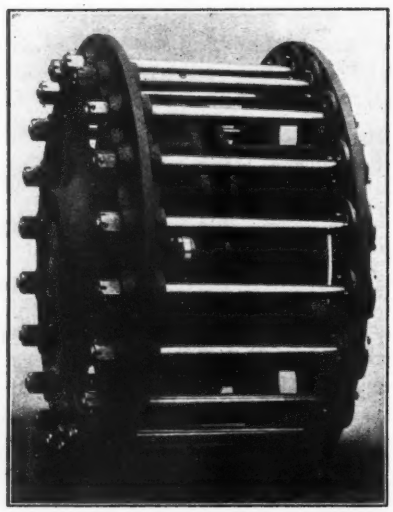
The governing body known as the Port of London Authority has decided to install electrically driven pumps at the Royal Victoria and Royal Albert Docks in London (England), to raise the present level of the docks by about two feet six inches.

A REMARKABLE 7,000-HORSEPOWER ELECTRIC ROLLING-MILL MOTOR EQUIPMENT.

BY FRANK C. PERKINS.

At the iron and steel works of the Georgs-Marien-Bergkerksund Hutten Verein there is in operation a most successfully electrically driven rolling mill. The details of construction and operation of this plant may be noted in the accompanying illustrations. The electric power for operating the rolling mill is supplied from a large gas-engine electric generating plant using waste gases as a fuel. The electric energy is distributed about the rolling mill to the various motors as a direct current of 500 volts' pressure.

It may be stated that the main rolling mill which is electrically driven was constructed at Mulheim by Thyssen and Company and consists of rolls 900 millimetres in diameter and 225



6,000-HORSEPOWER COUPLING BETWEEN FLYWHEEL AND FOUR MACHINES OF MOTOR-GENERATOR SET.

millimetres in length. The live rolls conveying the steel to the mill are operated by two electric motors of forty-horsepower capacity having a speed of 510 revolutions per minute.

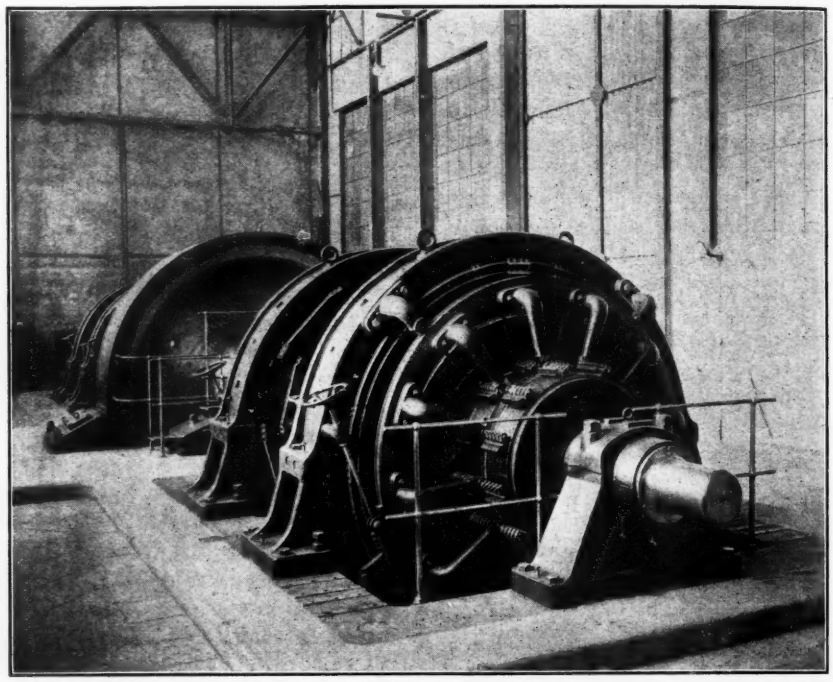
A large, direct-current, shunt-wound, double motor is used for driving the rolling mill proper. It has two armatures and two fields mounted on one base and has a capacity of 7,000 horsepower. The torque is said to be 85,000 metre-kilogrammes, and the motor operates at a speed of sixty revolutions per minute.

For producing this enormous torque and for regulation in driving the mill without overloading the generating equipment there is employed a large flywheel motor-generator set on the Ilgner system which was developed initially for use with mining-shaft hoists.

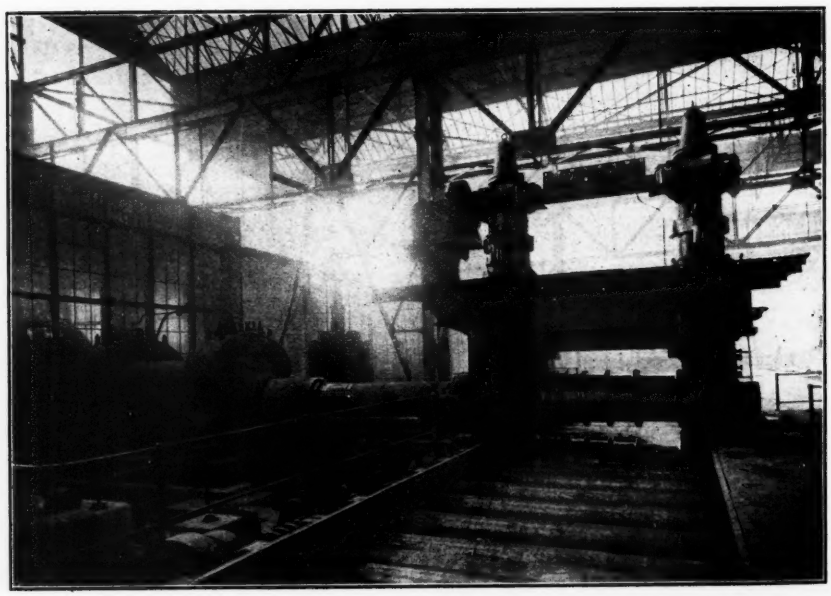
The motor-generator set includes four direct-current machines, each of which has a capacity of 1,300 horsepower and operates at a speed of 350 to 450 revolutions per minute. An enormous flywheel is mounted on the common shaft of these machines in the center and gives up its energy to the dynamos when needed at the time of maximum torque of the rolling-mill motors as the steel passes between the rolls.

One of the 1,300-horsepower machines acts as a motor in the operation of this Ilgner motor-generator set while the other three are driven as dynamos by the motor and the momentum of the flywheel. These are connected in series, each supplying a pressure of 500 volts, so that the highest pressure received by the rolling-mill double motor is 1,500 volts, or 750 volts for each armature.

The flywheel weighs thirty-five tons



ILGNER MOTOR-GENERATOR SET WITH THIRTY-FIVE TON FLYWHEEL IN CENTER



GERMAN ELECTRICALLY DRIVER ROLLING MILL.

and has a peripheral speed of ninety metres per second. A special coupling is provided for connecting the flywheel with the four machines. The couplings were designed and constructed by the Siemens-Schuckertwerke of Berlin, for a capacity for 6,000 horsepower.

At the instant when the steel ingots weighing 2,200 kilograms to 2,675 kilograms pass through the rolls, an enormous amount of power is required, and the thirty-five-ton flywheel gives up a part of its energy to the direct-current machines so that the latter may supply the necessary current to the rolling-mill motors. It is stated that this electric rolling mill has given excellent and economical service since it was installed, the regulating system and control working perfectly.

A Portable Electro-Hydraulic Riveter.

A new application of electricity is evinced in a portable electro-hydraulic riveter which is being put on the market by a prominent Swiss engineering firm. The machine is very compact, all the working parts being mounted on the upper part of the steel frame, just above the gap. A motor of from four to six horsepower, and designed to run normally at a speed of 1,420 revolutions a minute, drives a differential piston-type pump through a worm reducing-gear and a pair of pitmans. The length of the piston stroke is one and one-half inches, and the pump makes 170 strokes a minute. The motor is provided with a starting resistance, and the water for the pump is mixed with from forty to forty-five per cent of glycerine to prevent freezing in cold weather. The riveting cylinder has a piston of 6.3 inches in diameter and a stroke of 2.75 inches, the cylinder being capable of withstanding pressures up to 90,000 pounds per square inch. The piston has a quick-return movement, its (downward) working strike being made at a speed of 16.5 inches per minute, and its return non-working stroke at a speed of seventy inches a minute. Full control is effected by means of a hand lever. It is stated that the 2,750-pound machine, which is designed for rivets up to seven-eighths of an inch in diameter, has accomplished, under normal conditions, the task of heading 1,000 rivets of three-quarters of an inch in diameter, in a working day of ten hours, with three men in attendance. Larger types of these machines are also made.

An English Wind Turbo-Electric Plant.

The following interesting description of a wind turbo-electric installation on a private estate at Bromyard, in Worcestershire, England, is taken from a recent issue of *The Electrician*, of London, England.

The plant is one of J. G. Childs and Company's standard wind turbines for electric driving, the wheel being twenty-four feet in diameter, and mounted upon a steel tower seventy-five feet high. It is placed 435 yards away from the house on some ground perhaps ninety feet above the level of the latter. The generator is placed in a small house at the foot of the tower, and the battery and switchboard are placed in one of the outbuildings of the house.

The current is conveyed from the generator at the foot of the tower to the battery by means of bare solid overhead copper cables, carried on porcelain insulators mounted on poles, in connection with which lightning arresters are fixed. The poles and the cross-arms are placed about thirty feet apart, the wood used in them being supplied from the plantation on the estate.

The governor is of a special design, with a speed variation of 400 to 1,600 revolutions per minute, and runs with its armature in a vertical position. It is carried on ball bearings and is driven by a five-inch belt from the vertical shaft of the wind turbine, the belt being on its edge. The generator is of four-kilowatt capacity, with a normal voltage of about seventy volts.

As it was desirable to have the whole of the control arrangements in the battery room, where the switchboard is placed, a separate field wire was placed on the transmission line along with the other conductors. This, also, is a bare copper wire carried on insulators.

The battery consists of twenty-eight cells having a discharge capacity of forty-six amperes for ten hours. The battery is divided into equal groups either of which can be used for supplying the lighting. The pressure on the lamps is twenty-five volts, Osram lamps being used. Arrangements are made for using fifty volts for power, as the plant, in addition to running the lights in the house (about 100 in all), also drives a fifty-volt motor for running a chaff-cutter, circular saw and root-pulping machine. This motor is placed in a shed about eighty yards from the house and is connected to the battery by means of an armored lead-covered cable laid in the ground. The chaff-cutting required for the homestead is easily dealt with by this machine, and also a considerable amount of firewood, etc., is sawn. The motor is belted direct to the various machines and only runs one at a time.

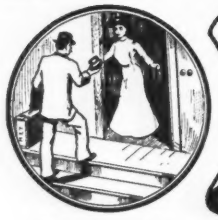
The plant is entirely automatic, being fitted with a patent tail gear, which gives very accurate adjustment to the wind. This arrangement consists of three tails, two of which stand out at about twenty degrees with the wheel. Two of these are connected together, so that when the wheel is required to stop they have only to be pulled down into a horizontal position, and the wheel immediately comes up into the wind and stops running. In the same way the tails are so balanced that when the wind reached a predetermined velocity, the tails tend to take the horizontal position, and so bring the wheel more or less out of the wind as the strength of the wind varies. In the recent gales which swept over the Midland counties this plant had a very good test of its stability, and though a very large tree was blown down close to it, the wind turbine suffered not the slightest harm.

In practice, it is found that the supply from the wind turbine is so reliable that it is almost the same as a supply laid on from the public mains, as the attention required by the plant is so small. All the main bearings carrying load are ball bearings, and the gear is enclosed in a cast-iron oil bath, so that if the plant were left for twelve months no harm would result from want of lubrication.

As the wind turbine is placed on ground somewhat higher than the house, and out of sight behind a wood, there is often a good wind blowing at the turbine when none is felt down at the house. The plant is guaranteed to produce 3,000 units a year, but in practice it produces at a much faster rate than this. In twelve hours a few days ago it produced fourteen units, with wind averaging fifteen miles an hour.

A New Electric Cure.

A new system of electro-therapeutics has been invented by K. Mueller, of Zurich, who is said to employ the effects of the electromagnetic field upon the body instead of the direct application of electric current. His invention is based upon observation of the superior health of men working in a strong magnetic field at St. Gothard Tunnel.



ELECTRICAL Advertising *and* Selling

GETTING AFTER UNWIRED HOUSES.[1]

AN ADVERTISING PROBLEM WITH "KINKS."

BY CHARLES A. PARKER.

"Going after unwired houses nowadays is about as pleasant as trying to satisfy a craving for food on what was left of the meal of a hungry tramp." This rather epigrammatic remark emanated one day from a very much disgruntled solicitor who was discussing with the manager an exceedingly barren day's work on the outskirts of town.

As far as the pleasure of going after unwired houses is concerned, his point was very well taken. It is, most decidedly, not a languid pastime suitable for whiling away a summer's afternoon. No more is it a work calculated to inspire one, by easy successes, to heights of enthusiasm. It is a selling problem, complicated by a generous assortment of "kinks."

Without a clear recognition of just what these kinks are, where they are, and how they may be straightened out, advertising, as well as soliciting, intended to "get" unwired houses will fall short of its purpose. No matter how complete one's knowledge of the subject is, hard, steady plugging and considerable patience are essential. Without that knowledge, complete success is impossible.

There is, however, an ample reward for the central station when it is finally successful in obtaining a wiring contract from the hard prospect, for it ultimately results in large revenues.

There can be no doubt about it—"going after" and "getting" unwired houses as an advertising problem is full of "kinks." But there is this consolation about it. When successfully figured out the solution is just as full of profits as the problem is of difficulties. And just because the problem is a hard one and the solution is profitable, it is all the more urgent that we get down to the essential points from the very first.

In this connection it must be understood perfectly that we are dealing chiefly with dwellings that have been erected for a number of years. Not with new homes of the better sort, in most of which electric wiring is installed as a matter of course.

This problem, like many others, offers its own solution. By a careful survey of the whole matter, we are able to determine all the elements that must necessarily enter into one's advertising if it is to be effective. With this in view, let us ask ourselves "what manner of men are they" to whom our advertising must go? By a process of elimination we can soon mark out the class of people we must attack.

From the very first we can ignore the homes of the rich. Their houses will be wired for electric light whether they represent the skill of modern architecture or date back to the Civil War. So, also, we need not bother ourselves a great deal over new homes that can scarcely be called mansions and still belong to the better class of dwellings. Their owners, too, will "see the light" without much effort on the part of the central station advertiser. It is pretty safe to figure that any man with four thousand dollars or upwards to put into a home will be wise enough to include electric wiring.

This does not mean that the central station advertiser can ignore this class of business, because he can't. If he does he will lose out. He can scarcely expect to have people come crowding into the office to hand his company their money. He must remember that there are other people in the field. He is apt to find the gas people or somebody with some one of the many "private" illuminating plants schemes, stepping in.

It pays to remember that all of these people can put up a mighty strong line of talk. And they often succeed because of the neglect of the central station advertiser. That gentleman tacitly recognizes the fact that we have been stating—namely, that in the natural course of events, houses of the better sort are wired for electricity. And he lets it go at that.

What we do mean by saying that the class of homes mentioned can be eliminated from our problem is simply that this phase of the matter presents no "kinks." Reasonable and ordinary effort is bound to swing this business to the central station. So, for present purposes, we need not consider them.

So far we have found that this advertising problem does not lie with mansions, old or new. Neither does it concern new houses that may be rated as "upper middle class." This brings us to "upper middle class" dwellings that were erected prior to the common use of electricity. When we reach this point in our scrutiny of conditions, we begin to get into our subject-matter proper. Houses of this sort are not always wired for electricity at the first opportunity, not upon the first suggestion. Some effort is required to get action. But even yet we have not placed our fingers upon the real "kinks." This class of house would never give a solicitor just cause for perpetrating pessimistic epigrams. Indeed, when we do arrive at the very source of the difficulty, we can drop consideration of them entirely. The solution of the real problem will be the answer to this as well.

Where, then, is the difficulty? To come at once to the point, "going out" and "getting" unwired houses is difficult for the central station advertiser because the great field of endeavor lies with the cheaper houses. Houses that, even when built today, are not wired for electricity unless won over by strenuous advertising effort. It is made up of the everyday homes of everyday, self-respecting American workmen.

Possibly our claim that this is a "kinky" advertising problem may be challenged as a superficial assertion. It will only be necessary, however, to point out the kinks themselves to demonstrate that all this is something more than mere "airy vaporings."

In the first place, our advertising must go to people who are so accustomed to other forms of illumination that they don't know what they are missing by not having electricity; people who are fairly well satisfied with gas and oil, and fear that, by changing,

1 The second of the series of articles on "Central-Station Advertising" appearing in the second issue of every month.

they may be flying "to evils that they know not of." Of still more importance is the fact that all of them are not educated to highest possible standard of living. A scientific explanation of the manner in which electricity does away with the exhaustion of the vital elements of the air would be beyond a good many. Few would appreciate a bare statement of the value of electricity as a decorative factor in "The Home Beautiful." The central station advertiser must also bump up against the ever prevalent fear of legal entanglements, and the common distrust of a public service corporation. Add to these things the fact that wiring up a home means a financial burden by no means as light as it is justifiable and you have the story complete. The "kinks" in our advertising problem will, we believe, stand out clearly. This, then, is the class of unwired houses which the central station advertiser must "go out" and "get." These are the people who must be won over to the great army of current users.

STRAIGHTENING OUT THE "KINKS."

There was a day when successful advertising in general was regarded as a sort of a mysterious process depending largely on good luck. To advertise electricity successfully was considered a job of even more subtle character than advertising in general. It was believed that the commodity offered for sale presented peculiar phases that called for a treatment altogether different from that given the ordinary commercial article. That day has gone by. The "kinks" of our unwired house problem that we have been enumerating can be straightened out by careful application of the rules that govern successful advertising in general.

In the first place, we must find the man we are after. That much has already been done. Next we must find out along what lines he thinks, what his attitude toward various phases of modern life is, what moves him to action, and what sets him more firmly than ever in his wonted path. But to do this much is not enough. The central-station advertiser must not only know these things but he must sympathize with his man's attitude. In short, he must look at the world with the other man's eyes. Only when he is able to do this, will he be able to advertise effectively to the man in "the unwired house."

At the very outset, we must recognize that life for the people we are after is a serious struggle. Work is the keynote of their existence. The man must toil to build up his little home, to guard against disaster, and to keep from slipping down a notch in his scale of living. So must the women work. The success of their homes does not depend upon the assiduity with which they attend mothers' meetings, or read women's magazines. It rests upon their ability to scrub floors, get meals on time, keep the children clothed and in school, and all without allowing their health to break down under the strain. Don't mistake our meaning—we are not referring to the class of people which is ground down to the very lowest extremity of life by a bitter struggle with poverty. That class is of little interest to us. The people with whom we are concerned, compose the great middle class — the people who must toil but who do so with steady hand, resolute eye and who cheerfully face whatever the future may have in store for them.

Looking at life as this class of people must necessarily do, we will see that they are peculiarly open to three lines of influence. They are interested in anything that will lessen the labor about the home, cut down expense, or give the home builders more time to devote to themselves, their children, and their pleasures. It will need no argument here to show that these very things are made possible by a "wired" home.

This, then, is the essence of the message that central-station advertising must bear to the man who is not yet a consumer of current. Later in this article, we will come back to message in detail. For the present, let us leave the matter here and take up another general step.

Of equal importance with the content of your advertising is the manner in which it is presented. Borrowing once more "the eyes" with which "our man" looks upon the world, we must realize that he is not a man satiated with all the sensations that are possible in life. His emotions are by no means jaded. He is not blasé. It does not take the most subtle of humor to make him laugh. Neither is his mental attitude so highly developed and so philosophical, that he is unaffected by the sentiment and pathos of everyday life. He has not yet reached the stage where he can rise superior to preconceived prejudices and notions. The man preparing central-station advertising to go to owners of "unwired houses" must bear these facts in mind. He must appeal to this man's sentiments, emotions and prejudices rather than to cold-blooded and unadulterated reason.

If he does the latter he is almost certain to fall short. So also if he fails to get right down to the particulars of everyday life. His appeals to humor and sentiment must not be placed on so lofty a plane, either in form or content as to miss the people he is after.

This does not mean that this class of advertising should be cheap and coarse. Not by any means. If there is anything worse than shooting over a man's head, it is insulting him with the matter beneath his notice. Advertising that arouses a man's resentment accomplishes nothing. Worse than that, it sets the advertiser back several notches.

Before getting deeper into our subject, it may be well to go back a little and sum up the points already made. We have, so to speak, isolated the man we are after. He is the man whose home is of the humbler sort and who, if left to his own devices, would cling to illuminating methods less modern than the electrical. We have also seen that our central-station advertising must emphasize the fact that it does away with drudgery in the home, that its economical features more than make up for its cost, and that it gives "time for better things."

THE MESSAGE IN DETAIL.

Be specific. Generalization, such as is permissible in an article, will not do in an advertisement. The central-station advertiser cannot tell his story all at once. But he can make a good point and drive it home. Its effect will be heightened by the next point he makes at some later date.

To enumerate the different arguments at the central-station advertiser's command is quite impossible in the space available even if it were necessary.

The point we are making here is just this. Instead of saying, as we have said in this article, "Electric light means less work," say, "Electric light means that you no longer have to fill lamps, trim wicks, etc." Instead of saying, "The cost of electric light is more than made up in the savings it makes possible," say, "You can more than pay for electric light with the

money you save in doctors' bills and decorating." Instead of saying, "Electricity gives the housewife more time to herself," say, "Electricity will give you more time for your children, your social obligations and your pleasures." Of course, these are very crudely put here; but we are only trying to make the point clear.

Avoid saying "We will," but rather "You can." Hammer away steadily at specific points. Show how electricity means purer air to breathe; how it saves eyesight; how it tends by making the home cheerful and bright, to keep boys off the street. Point out the fear burglars and tramps have of a light that can be switched on suddenly; tell the people how much safer it is to have children alone with electricity than with an open flame light.

Of course, the first aim is to arouse interest. To this end, try to make each advertisement not only as bright, cheerful and different in tone as possible, but make it appear as if each were an "event" to you. If people get the idea that you are advertising merely as a routine part of your business they are going to give you but little attention.

After your advertising has aroused interest, it must keep the mind of the reader moving along rapidly to the point where the proposition is finally put. The psychology of the situation is something like this. If you get the reader mentally saying, "Yes" to the various statements you make, he will find it hard to say "No," when it comes to a final proposition, which is the logical conclusion from what precedes.

The converse is equally true. If your man may and is likely to say "No" to your initial statements, he is going to say "No" to your final proposition.

There is another phase of the matter which is often neglected and rather obscure at best. That is the attitude the kind of people we are dealing with take toward advertising matter in general.

It would be asking too much to expect them to keep in close touch with the science of modern advertising, to appreciate it more as "business news" and salesmanship rather than as "only advertising." To the man who is strictly in touch with progress along these lines, the fact that advertising is advertising makes little difference. If good, it gets attention. In fact, he is apt to resent matter that gets his attention under a pretense of being something that it is not. The man in the "unwired house" is apt to look at things differently. If he spots a thing at the outset as "just advertising," he is more apt to disregard it than if it gets to him as "a special offer," a "bulletin" or a "letter." Not that good straight-away advertising loses out entirely; but the other stands a better chance of getting favorable attention.

For these reasons, as well as for the reason that you are advertising not to the general public, but to a well-defined class of persons, mail advertising is the most effective form possible.

One of the best forms of advertising has been found to be the monthly house organ. Probably there is no point we have touched upon in this article that does not act as an argument for the little monthly magazine. It is an easy means of appealing to every side of the reader's nature, his emotions, his sentiments, and his reason. Its real advertising character is more or less concealed. At least, it is not so evident as to be objectionable. Coming every month it carries interest in it from one issue to another.

In addition to these points, it has the added advantage of being more or less in the nature of "something for nothing." Is it not a magazine? Does it not contain attractive views and reading matter? This "something for nothing" feature can be played to advantage just as strongly as the central-station advertiser's appropriation will permit. Not only is it a guarantee of attention, but it conveys the impression that the company is not a "grasping monster" but a "public service corporation" with emphasis on the word "service."

Let us suppose that our advertising is right up to the mark in every one of the essentials we have mentioned. Now we must add something else—persistence.

As we said in the beginning, this is an advertising problem full of "kinks." We are not going to get our man at once. We may have to educate him to a somewhat higher standard of living. We must show him that it is not the purpose of the central station to entrap him into a pitfall. We must prove to him that electricity is valuable enough to justify the outlay of money that is necessary. All this takes time and must be done before we "get action."

But this alone will not always produce results. As a matter of fact, while it is quite possible to get a man to agree with you that your proposition is everything that could be claimed for it, it is another thing to make him act.

HOW TO GET ACTION.

The central-station advertiser whose matter leaves "the man in the unwired house" hanging in the air after each ad is not going to get "quick action." Neither will it do to always wind up with a general request to "wire up the house."

Have some definite proposition to make. Outline a course of action to be taken. As often as not, action is delayed simply because the man you are after does not know quite what to do. The least you can do is to ask him to drop a card and have your representative call.

Be sure and impress him with the fact that, while you are perfectly ready to give him your time, and all the information he desires, you are not asking him to obligate himself in any way.

But this is not going far enough. Have some definite and generous proposition to make. How would it be to agree to put an electric light in his living room and let him try your services on that small scale for a definite period? This would certainly "get" the man who was hesitating in the score of expense alone. Here is another alternative, agree to wire up the house, and if at the end of a certain time your services are not wanted, take the wiring out free of charge. This of course could not very well be promised by companies not doing the active work of wiring. Here is another scheme that would not only bring business, but would increase current consumption. Agree to give every woman whose home was wired within thirty days, an electric flatiron free of charge. This would certainly be worth while and would be generous enough to attract everybody's attention.

Another way of arousing interest and getting action would be to institute contests among school-children. This has been tried in more than one case with remarkable success. One contest might offer a generous prize to the pupil writing the best essay on "Why Our Home Should Be Lighted by Electricity."

Another might be for soliciting. It would of course be asking pretty much of school boys and girls to require them to close a contract for wiring.

But they could stir up prospects. The contest should be decided on points, say ten points for each name brought into the office and fifty for each one that the solicitor turned into a contract. Small blanks should be furnished the contestants which their prospects would be required to fill out, answering the questions asked and requesting the solicitor to call.

This would get a hearing for the representative from practically every unwired house owner in the town. The fifty points for actual contracts would make each contestant realize that prize was to be won, not on names alone, but on business done. Now if the prize be valuable enough and be placed on exhibition in the company's office, it will further the good work by bringing a good many prospects right into the home of the company.

Any variety of plans to get action may be devised, but the principle underlying all of them must be this. Have something definite to offer, and outline simple steps for the people to take. An advertising campaign built up along these lines by a clever central-station advertiser is certain to be productive of results and will do much to eliminate "barren days" from the solicitor's history.

WHAT ABOUT PEOPLE WITH HOUSES TO RENT?

So far we have apparently neglected people in rented houses. But there is "method in our madness." Before he induces the landlord to "wire up," the central-station advertiser must of necessity do much to educate the people who pay the rent to want electricity.

A campaign going to owners of the class of homes we have been dealing with so far, if successful, is going to help in this educational work. When renters see friends of theirs in homes no better than their own using electricity, they are going to want it too. What's more, they will be willing to pay more to get it.

Of course a campaign directed right to these people will help a great deal. But it must be handled diplomatically. Otherwise it will antagonize the landlords. When it comes right down to actual work, however, the last named gentlemen must be the objects of your attack. With them the matter is largely one of dollars and cents. But there are, nevertheless, plenty of reasons why landlords should prefer to have their property lighted by electricity. Not only do their houses rent and sell easier, but they bring more money in either case.

There are still other reasons for wiring up. Renters are notoriously careless about the house. Match scratches on the wall, smoky ceiling and sooty decorations are bad enough when people are cautious. But when renters occupy a dwelling, it is necessary to redecorate after almost every change of tenants. Add to this the fact that electricity removes one of the greatest sources of fire, and you have a case which should make even the most selfish landlord come around.

ADVERTISING IS ESSENTIAL.

It is only necessary to remark, by way of conclusion, that the field of unwired houses is one where the central station that does not advertise loses out. Only by advertising will the amount of business be secured that should be secured. People will wire up their homes who otherwise would never have thought of it. The solicitor will find new prospects being suggested all the time. He will be enabled to cover much more ground than formerly, close more contracts, and come into the office after his day's work with but little reason for hurling sarcastic epigrams at the manager.

The "Electric Shop" Brochure.

It has often been said that the general principles of the publicity and sales departments of central stations are well established on rational lines, but it cannot be said that in the case of the various sub-departments there exists at present that uniformity of purpose and action which indicates thorough understanding of the subject. Especially does there appear to exist some lack of understanding or uniformity of ideas as to the precise lines on which the electric show room should be conducted.

While these statements are generally true there appears an unmistakable exception to the rule in the case of the Commonwealth Edison Company, of Chicago. This central station, which by many has been considered the pacemaker in central-station advertising, has for the past year conducted an elaborate show room in one of the prominent buildings of the downtown district, which, it is safe to say, has not been equaled by any other central station. During the brief year of its existence it has received a vast amount of publicity and it has probably been an important factor in the constantly increasing revenue of the Commonwealth Edison Company.

To further inform the public as to the unlimited number of electric appliances displayed there, this company has recently published elegant brochure pertaining to it which marks a new era in central-station literature. This artistic publication is devoted entirely to the "Electric Shop" of the Commonwealth Edison Company and explains what it is and what it means. In the words of the author the Electric Shop is the latest exemplification of the comfort, convenience and luxury attainable by the use of electricity in the home. It is a quiet, beautifully appointed, high-class shop where one can do all of one's electrical shopping. All of the decorations are sumptuous and elegant, specially designed by artists of experience and taste.

As the Electric Shop is divided into several rooms designed to display various classes of the applications of electricity, likewise, following a general introduction in the pamphlet, each room is treated separately by the author, and all of the equipment is described in detail. Particular attention is given to the illumination as well as the numerous displays of electric heating devices and motors for various household purposes.

The brochure is beautifully bound and finished. The cover design includes an embossed emblem of the Electric Shop. The descriptive matter covering thirty-four pages is illustrated throughout by beautiful tinted photogravures. In every feature this publication is a work of art. It represents a considerable expenditure, but this was believed necessary in order to harmonize with the elegant appointments of the Electric Shop itself.

The Electric Shop brochure is being distributed for the Commonwealth Edison Company by Dana H. Howard, advertising manager. The text was written by William E. Keily and the Binner-Wells Company were the designers and printers.

The December calendar of the Denver Gas and Electric Company, Denver, Colo., makes many suggestions for useful electrical Christmas gifts. This central station distributes an illustrated calendar each month containing a timely advertisement of some electrical appliance.

Some Effective Booklets of Central Stations.

With the steady increase in the use of electrical energy for lighting, power and domestic purposes there has been correspondingly increased competition with rival systems. For this reason, and also because of the fact that many prospective customers of current are still ignorant of the many advantages of electricity, central stations have found it necessary to include in their organizations a complete and self-contained staff whose duty it is to disseminate information concerning the advantages resulting from the use of electrical energy. This staff, commonly called the publicity or new business department, is now an important factor in every central-station organization.

The general methods of publicity campaigns are now well understood. Much has been written on the subject and has received the attention of central stations throughout the country.

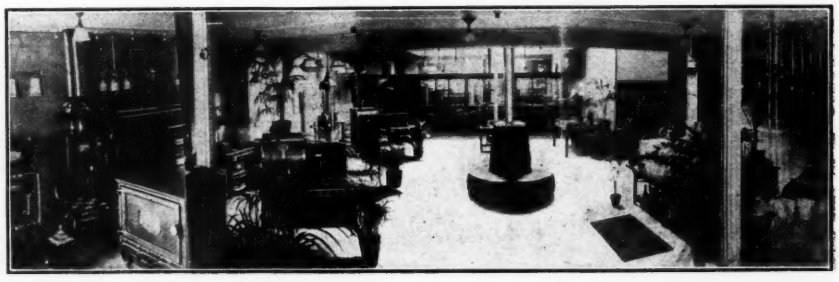
EXAMPLES OF EFFECTIVE BOOKLETS.

That the practice of this important department may now be said to be well established on rational lines and that fairly standard methods are in operation is shown by the attractive and effective booklets being distributed by numerous central stations.

In the accompanying illustration we reproduce three of these booklets as being typical. These particular publications are being distributed by the Central Georgia Power Company, of Macon, Ga., and possess all of the characteristics necessary in an advertisement of this description. They are printed on a good quality of paper, are attractively bound and the arguments presented are brief but convincing. These booklets are distributed at regular intervals in the order in which they appear in the illustration. The one entitled "There Is Life in the Old Land Yet!" is a general introduction to those which follow, and contains a brief history of the development of the Central Georgia Power Company, and in the words of the booklet, "bears on the potential force that will transform Central Georgia into a great industrial beehive." The other two publications shown are addressed to manufacturers and contain convincing arguments in favor of electricity for industrial purposes.

The Keyes Electric Company, Gowanda, N. Y., is distributing a booklet which will undoubtedly secure favorable comment and which affords an excellent example of the high standard attained by central-station publicity departments. It is the style of advertisement that will be read throughout, and on account of its style will undoubtedly create an interest, which, if properly followed, will result in a customer.

"Why Boston Is Growing" is the title of a circular being distributed by the Edison Electric Illuminating Company, of Boston, Mass. It contains eight pages of interesting data and concludes with a paragraph which announces that a special department of the company attends to all inquiries about valuable locations for business and manufacturing purposes and for homes in Greater Boston; also that the company co-operates with all real estate dealers and commercial organizations and spares no effort in helping Greater Boston grow. This attitude is one which all central stations would be wise to follow.



MAIN OFFICE OF THE EASTON GAS AND ELECTRIC COMPANY.

Growth of Easton Gas and Electric Company.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of August 7, 1909, there appeared a brief account of the reorganization and subsequent progressiveness of the Easton Gas and Electric Company, of Easton, Pa. On November 1, 1909, this company extended to the people of Easton an invitation to be present at the opening of its new offices, a view of which is reproduced herewith.

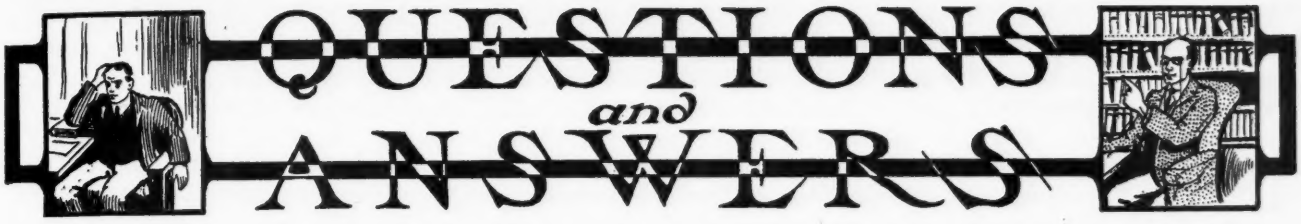
Since the organization of the new company it has followed an aggressive business policy, and on account of the liberal advertising the public in general has always been kept in touch with the advantages it has to offer at all times. The plants and equipments of the corporation have undergone extensive changes and thousands of dollars have been expended for modern appliances and machinery.

The opening of the new offices marked a new era in the history of the company. Practically the entire population of Easton accepted the invitation to be present at the opening, and the affair was a decided success from every point of view. As may be seen, the offices are tastily furnished and arranged, and particularly in the sales room and display room every modern convenience has been provided for the comfort of visitors. Probably one of the principal reasons for the rapid growth and development of this central station is the fact that at all times it has taken the public into its confidence. It maintains a free service department in which a dozen experts are at the call of the public for inspection to better service or to furnish estimates on contemplated changes, and it has been made a cardinal practice of the company that courtesy and careful attention be given by all of its employees at all times to everybody.

Building Up the Load.

The People's Incandescent Light and Heating Company, of Meadville, Pa., has arranged to give several demonstrations regarding the heating ability of electricity.

Hitherto the use of electricity for general purposes in that city has been rather limited, due perhaps to the fact that electricity was available only to a limited section of that city. This progressiveness on the part of the central station follows the general extension of all transmission lines throughout Meadville.



WIRE FOR AN ELECTRIC HEATER—I want to make an electric heater to be connected to a 500-volt, direct-current circuit. It is to be used on an electric railway bonding car for heating coffee and similar purposes. I wish to use Nichrome resistance wire, but the amperage is of no consequence. Can you help me determine the size and amount of wire to be used?—P. R. S., Sacramento, Cal.

A problem of this kind was considered in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 20th, page 999. As in this case, however, the conditions are a little more specific, it is possible to work out the problem on certain assumptions. These assumptions will be that the heater shall be capable of bringing to the boiling point, within five minutes, about two quarts of water. To simplify the calculations metric units will be used and a further assumption made that the quantity of water is equal to two litres. To make certain that the water will actually reach the boiling point, it will be well for the resistance element itself to run at a slightly higher temperature, say 110 degrees Centigrade. Therefore, to raise the temperature of two litres of water from, say, twenty to 110 degrees, there will be required 180 calories of heat energy. Since each calory requires 1.19 watt-hours, it will be necessary to furnish 214.2 watt-hours. To further provide for heat losses in the heater it will be assumed that 240 watt-hours are to be provided. This amount of energy must be furnished in five minutes, or at the power rate of $2.40 \div 5/60 = 2{,}880$ watts. Since the power is to be 2,880 watts supplied from a 550-volt circuit, 5.2 amperes will be the heating current necessary. The requisite resistance of the heating element will have to be $550 \div 5.2 = 106$ ohms. The nearest size of Nichrome wire that is capable of carrying this current at a temperature of about 230 degrees Fahrenheit, is No. 15. This wire has a resistance of 185.6 ohms per 1,000 feet. Therefore, it will require about 575 feet, or about 5.25 pounds of the wire.

INDUCTION MOTOR CONTROLLER—A controller that I have under my care gives a great deal of trouble on the reverse. It throws fire out of the casing, and gives a violent report. On examining it I find the fingers of the switch and also the cylinder switch badly burned, but I found no ground on testing it carefully. This only happens on reversal. It gives the operator a violent shock, and also opens the circuit-breaker every time it happens. The controller is a thirteen-point controller for a three-phase 440-volt motor. What is likely to be the trouble and the remedy?—R. P., Hebron, Colo.

In all likelihood a portion, if not all, of the resistance in the rotor circuit at the controller is short-circuited when the controller arm is reversed. This causes a very heavy rush of primary current opening the circuit-breaker, and also an exceptionally heavy secondary current which has evidently burned the switch contacts. This short-circuit may be due to a loose connection or wrong connection that develops at one of the contacts on reversal. It would be necessary to examine the controller with great care, removing any substances that may have become lodged between the contacts, and thoroughly cleaning and tightening them.

GASOLINE COMPETITION—We are having considerable difficulty in encountering competition from gasoline lighting. Have any definite data been published as to the relative costs of gasoline and tungsten lighting? I expect that the electric service may cost somewhat more than the installation of a gasoline plant, but I hope to convince any one that it will be in the end as cheap and more serviceable when all things are considered. Can you direct me to any information on this subject?—J. M. R., De Witt, Iowa.

No direct comparisons of such costs that are reliable seem to be available. The agents of gasoline lighting equipments profess to supply figures showing that the cost of gasoline lighting is very much less than that of electric lighting. In such estimates, however, scarcely any allowance is made for maintenance of mantles, chimneys, and other features connected with the system. Nor is the depreciation of the plant allowed for. Another factor that is not given proper attention is the great fire hazard of such an installation, and this alone may often be used as an excellent argument to stir up public objections resulting in ordinances barring such plants. Little consideration is given to the great amount of care required by a gasoline plant in order to keep it in good working order. As this care is not given to it constantly, it very commonly results in very poor service, if not ultimately in disastrous fires. At the recent convention of the Illinois State Electric Association, at Alton, Ill., this subject received some consideration, and it seemed to be the opinion of many that if the electric company will buy up some of the gasoline installations at their actual worth, and offer to put in any of them for comparative trial with electric service, using tungsten lamps, that the latter invariably wins out in every case.

TROUBLE IN A RAILWAY SUBSTATION—In a railway substation, equipped with 600-kilowatt, six-phase rotaries and single-phase air-blast transformers, fed from 13,200 volts, there is frequently an immense rush of current when the automatic oil switch is closed. This sometimes trips the circuit-breaker, which is set for 150 per cent load. A great vibration of the sheet-iron sides of the transformer cases is set up, which gradually dies down in about three seconds. I also notice that on no load the field rheostat can be shifted throughout the whole range without causing the alternating-current ammeter to vary more than a few amperes, but the direct-current voltmeter reading varies over 100 volts. Is it necessary to shift the brushes of a rotary to prevent sparking at different loads?—G. A. R., Excelsior, Minn.

The excessive rush of current is probably due to the fact that the rotary converter is not exactly synchronized at the instant that the switch is closed. That is, if the rotary is not in step a very heavy temporary current is bound to result. This heavy rush of current probably also causes the excessive stray field flux about the transformers, which may partly be the cause of the vibration in their cases. The effect of variation of the field rheostat of the rotary on the no-load current must be comparatively small, because that current itself is very small, and the index of the ammeter is probably registering in

a portion of the scale that is crowded. The field variation does affect the power-factor of the circuit, and should produce some change in the current due to the variation of its wattless component. If the rotary is provided with reactance coils, and if it is compounded, field variation will affect the direct current voltage. Most rotaries are designed now so that it is not necessary to shift the brushes for various loads in order to prevent sparking.

WATT-HOUR METERS OPERATING AT HALF VOLTAGE—If a 220-volt direct-current watt-hour meter be placed on a 110-volt line, in what ratio will the dial readings be correct? Will the characteristics of the meter be the same on the two circuits?—M. P. S., Monmouth, Ill.

If the watt-hour meter is placed on a circuit having exactly one-half of the voltage for which the meter was designed, it is evident that the pressure circuit of the latter receives only one-half of the current that it normally would, so at first sight it would seem as if the reading of the meter should be multiplied by two. However, the current that the pressure circuit carries is proportional to the exact voltage of the circuit, just as that which the series circuit carries is proportional to the current used on the circuit. Therefore, the readings of the meter are still proportional in the same ratio as formerly to the product of the amperes and volts, or, in other words, the meter should continue to record exactly the number of watt-hours that is actually consumed in the circuit. From this it does not follow that a 220-volt meter is suitable for a 110-volt circuit unless the latter will not carry a greater amperage than the 220-volt circuit. Should the same amount of power be used on each circuit, it is evident that the current on the 110-volt circuit will be twice that on the 220-volt circuit and therefore that the series coil of the watt-hour meter must be capable of carrying twice as much current as when used on 220 volts.

Commonwealth Edison Company.

The directors of the Commonwealth Edison Company on December 7 formally voted a ten per cent increase in the capital stock, or $3,000,00. It will be offered pro rata at par to shareholders on February 1. The first payment of twenty-five per cent will be due on that date. The remaining installments will be payable twenty-five per cent on May 1, August 1 and on November 1.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MASSACHUSETTS ELECTRIC COMPANIES.

The tenth annual report of the Massachusetts Electric Companies, covering the year ended September 30 last, shows slight increases in gross and net earnings over 1908. Charges were practically unchanged, with the result that the balance available for dividends increased $102,775.

Dividends for the year amounted to $1,000,464, against $880,773 a year ago. Surplus was $125,365, against $142,281. The consolidated income account of the operating companies for the last three years compares as follows:

	1909.	1908.	1907.
Gross earnings	$8,052,355	$7,809,010	$7,758,511
Expenses	5,148,396	5,001.517	5,000,652
Net earnings	$2,903,958	$2,807,492	$2,757,858
Charges	1,778,128	1,784,437	1,702,622
Balance	$1.125,829	$2,023,054	$1,055,235
Dividends	1,000,464	880.773	880,773
Surplus	$ 125,365	$ 142,281	$ 174,462

The profit and loss account of the holding or parent company compares, for three years, as follows:

	1909.	1908.	1907.
Div. on stock owned.	$ 967,630	$ 880,841	$ 880,837
Misc. int. on notes.	127.169	107,961	82,003
Total income	$1,094,799	$ 988,802	$ 962,840
Total expenses	19,395	19,395	16,629
Net income	$1.075,404	$ 969,407	$ 946,211
Int. on notes	157,500	157,500	157,500
Net div. inc.	$ 917,904	$ 811,907	$ 788,711
Dividends	513.935	.....	.....
Surplus	$ 403,969	$ 811,907	$ 788,711
Profit sale of stocks	115,997	.....	.....
Prev. surplus	2,378,791	1,566,884	778,173
Total surplus	$2,898,758	$2,378,791	$1.566,884

President Gordon Abbott comments on the year's business as follows:

"The year as a whole showed an increase in gross earnings for all the companies of $258,842 (three and one-third per cent.) Operating conditions during the year have been sufficiently favorable, owing to the low price of supplies, to produce an increase of $125,000 in net earnings despite increasingly liberal expenditures on maintenance over those of previous year, of which $42,569 was absorbed by dividends on preferred shares of operating companies. Remaining increase in net was large enough to justify the Old Colony Street Railway Company in increasing its dividend from four per cent to five per cent.

"On July 1 a dividend of one and one-half per cent was paid on preferred shares of the Massachusetts Electric Companies, and the trustees have felt justified by the results of the year in increasing distribution on January 1 next to one and three-fourths per cent. Although earnings for past year would appear to justify declaration of a dividend at a higher rate, trustees are of the opinion that the time has not yet come when it would be wise to resume the four per cent rate, in view of the fact that the past year is the first since 1903 in which the full four per cent was earned. They think interests of shareholders will be best served by maintaining a strong financial condition until the earning power of property has been demonstrated over a longer period."

The subsidiary operating companies of the Massachusetts Electric Companies are the Boston & Northern Street Railway Company, the Old Colony Street Railway Company and the Hyde Park Electric Light Company. The Boston & Northern operates under lease the Boston & Chelsea, the Boston & Revere, the East Middlesex, the Winnisimet and the Nashua Street Companies. The Old Colony operates under lease the Newport & Fall River Street Railway Company and the Newport Illuminating Company.

RUTLAND RAILWAY, LIGHT AND POWER.

The Rutland (Vt.) Railway, Light and Power Company reports for the twelve months ended October 31, 1909, as follows:

Gross	$254,905
Expenses	131,730
Net	$123,175
Interest and taxes	81,396
Surplus	$ 41,779

CENTRAL PARK, NORTH AND EAST RIVER RAILROAD.

The New York Public Service Commission has issued a report covering the operations of the Central Park, North & East River Railroad Company for the period from August 6, 1908, to June 30, 1909, as follows:

Revenue from transportation	$488,167
Advertising privileges	13,143
Rent of land and buildings	10,980
Rent of carts and trucks	465
Total operating revenue	$512,755
Maintenance of way and structure	11,235
Maintenance of equipment	28,933
Exp. horse car service	117,689
Hired power	60,807
Operation of cars	172,312
General expenses	31,047
Total operating expenses	$422,023
Net operating revenue	90,731
Taxes accrued	12,803
Operating income	$ 77,928
Other income	236
Total income	$ 78,165
Rent of cars, car house, etc.	13,236
Surplus June 30, 1909	$ 64,928

M'ADOO TUNNEL SURPLUS.

An abstract of the annual report of the Hudson & Manhattan Railway Company—the operating company of

the McAdoo tunnel system—for the year ended June 30 has been made public by the New York Public Service Commission. The income account shows a surplus of $64,370 for the year, after the payment of such part of the total interest charges as the officials thought proper to charge against operation, thus reducing the corporate deficit from $116,820, where it stood at the end of the first year, to $52,449.

MICHIGAN UNITED RAILWAYS.

The Michigan United Railways Company has issued its full annual report for the year ended April 30, 1909. The income account compares as follows:

	1909.	1908.
Gross revenue	$1,021,128	$942,003
Operating expenses	568,157	521,728
Net revenue	$ 452,971	$420,275
Other income	5,667	1,321
Total income	$ 458,638	$421,596
Charges	305,891	262,720
Surplus	$ 152,747	$158,876
Preferred dividend	60,000	60,000
Surplus	*$ 92,747	$ 98,876

*Equal to 1.54 per cent on $6,000,000 common stock.

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of October and ten months ended October 31, 1909, compares as follows:

	1909.	1908.
October gross	$ 596,962	$ 554,166
Expenses	277,174	265,892
October net	$ 319,787	$ 288,273
Charges, taxes, preferred dividends	140,251	138,667
October surplus	$ 179,537	$ 149,606
Ten months gross	5,773,382	5,319,967
Expenses	2,709,742	2,637,918
Ten months net	$3,063,640	$2,682,050
Charges, taxes, preferred dividends	1,388,761	1,283,789
Ten months surplus	$1,674,879	$1,398,261

AMERICAN TELEPHONE.

The report of the American Telephone and Telegraph Company for ten months ended October 31, 1909, compares as follows:

	1909.	1908.
Dividends	$14,070,677	$12,550,557
Interest and other revenue	8,881,897	8,087,076
*Telephone traffic net	3,609,592	3,173,495
Real estate	80,454	135,517
Other sources	1,137,258	647,908
Total	$27,779,879	$24,594,552
Expenses	2,095,191	1,736,061
Net earnings	$25,684,687	$22,858,491
Interest	6,018,789	6,380,746
Balance	$19,665,898	$16,477,745
†Deduct difference	15,725	.....
Balance	$19,650,172	$16,477,745
Dividend for nine months.	11,963,758	9,289,624
Balance	$ 7,686,414	$7,188,121

*In 1909 all maintenance and depreciation is charged against expenses monthly instead of being partly provided for by an extraordinary charge in December as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as now presented include in expenses for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908.

†Deduct difference between interest paid on negotiable stock receipts and dividends received from stock acquired in exchange for such receipts.

AMERICAN POWER AND LIGHT.

The American Power and Light Company has issued a statement of income for the month of October and twelve months ended October 31, 1909, which compares as follows:

	1909	1908
Gross	$ 64,654	$ 54,523
Expenses	38,992	38,053
Net	$ 25,662	$ 16,470
*Int. on bonds and floating debt	5,078	4,966
Surplus	$ 20,584	$ 11,504
Twelve Months—		
Gross	$816,748	$675,390
Expenses	540,040	485,571
Net	$276,708	$189,819
*Int. on bonds and floating debt	62,261	58,035
Surplus	$214,447	$131,784

*Exclusive of interest on bonds and floating debt owned by American Power and Light Company.

American Power and Light Company commenced business in September, 1907, but for comparative purposes the earnings of its local properties are given irrespective of the dates of their acquisition.

At a meeting of the American Power and Light Company the following were elected directors: Russel Armstrong, A. C. Bedford, R. E. Breed, A. W. Burchard, F. L. Dame, vice president; S. Z. Mitchell, chairman of the board; F. G. Sykes, president; F. C. Walcott, Henry W. Wehrhane, H. P. Wright, A. M. Young.

NORTHERN OHIO TRACTION AND LIGHT.

The report of the Northern Ohio Traction and Light Company for the month of October and ten months ended October 31, 1909, compares as follows:

	1909	1908
October gross	$184,815	$157,532
Expenses and taxes	100,800	90,258
October net	$ 84,015	$ 67,274
Charges	44,114	43,778
October surplus	$ 39,900	$ 23,495
Ten months gross	1,818,986	1,578,084
Expenses and taxes	988,529	912,300
Ten months net	$830,456	$665,784
Charges	437,456	438,521
Ten months surplus	$393,000	$227,263

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Valley Traction Company, for the month of October and ten months ended October 31, 1909, compares as follows:

	1909	1908
October gross	$ 122,805	$ 113,390
Expenses	70,385	59,931
October net	$ 52,420	$ 53,459
Ten months gross	$1,161,155	$1,092,090
Expenses	678,924	613,400
Ten months net	$ 482,231	$ 478,690

AMERICAN CITIES RAILWAY AND LIGHT.

The American Cities Railway and Light Company reports the combined earnings of its operating companies for the month of October of $524,706, an increase of $43,705, and surplus, after interest and sinking fund, of $110,500, an increase of $26,798. Following are the figures for October and ten months ended October 31, 1909:

	1909.	Increase.
Gross earnings	$524,706	$43,705
Expenses and taxes	306,999	14,173
Net earnings	$217,707	$29,532
Interest and sinking fund	107,207	2,734
Surplus	$110,500	$26,798
Am. Cities proportion surplus on basis stock ownership	97,377	23,692
Am. Cities prefd. div.	34,530	.....
Balance applicable to com. stock and reserve	62,846	23,692
Equivalent on Am. Cities outstanding com. stock	7.0%	.....
January 1 to October 31—		
Gross earnings	$4,750,809	$282,514
Expenses and taxes	2,761,247	60,431
Net earnings	$1,989,562	$222,083
Interest and sink. fund	1,063,568	20,870
Surplus	$ 925,994	$201,213
*Am. Cities prop.	818,018	182,710
Am. Cities prefd. div.	345,305	.....
Balance applied to com. stock and reserves	$ 472,713	$182,710
Equiv. on Am. Cities outstanding com. stock	5.27%	.....

*American Cities proportion of surplus on basis of stock ownership.

Illinois Tunnel Company Goes Into Receivership.

On December 2 receivers were appointed for the Illinois Tunnel Company on proceedings entered in behalf of the Corporation Trust Company of New Jersey. The Illinois Tunnel Company, it will be remembered, owns the very extensive network of freight tunnels in the downtown district of Chicago. They are provided with an electric railway for transportation of coal and other freight between the railroad terminals and the downtown office and mercantile buildings. The receivers appointed were Chas. G. Dawes, David R. Forgan and Edwin A. Potter.

The proceedings were brought on account of failure to meet interest charges on the bond issue of $30,000,000. It is believed that another reorganization will be effected. The Chicago Subway Company is at present the actual holding company, but its affairs are not immediately involved in this receivership. Current belief is expressed in financial circles that an assessment on the stock may get the company out of its financial difficulty. The net earnings recently have not been greater than $240,000 a year. The loss of the mail contract with the postal authorities was a serious blow to the company during the past year. If this contract had been renewed, the earnings would have been increased between $350,000 to $400,000.

The Chicago Warehouse & Terminal Company, which is affiliated with the Tunnel Company, was placed in receivership simultaneously.

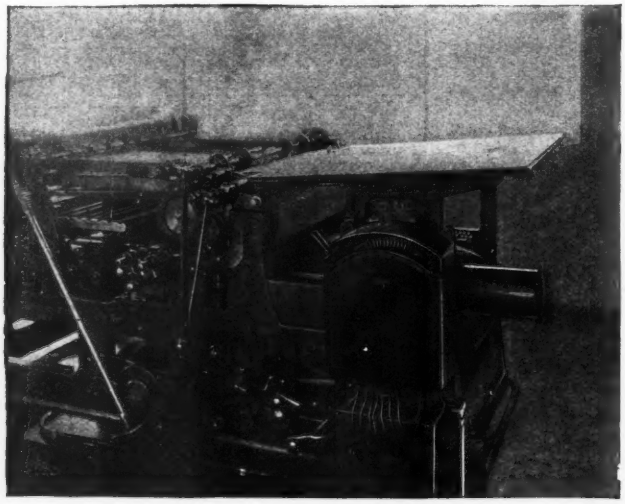
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

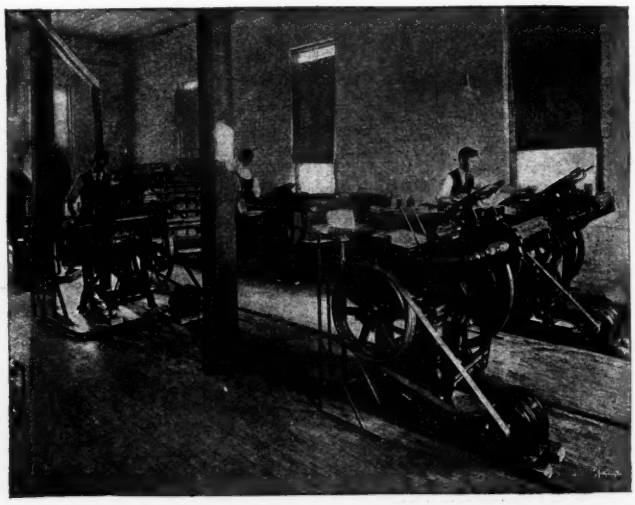
The Electric Drive for Printing Establishments.

The character of the service in printing establishments usually makes it desirable to install the individual motor drive. Among the principal advantages over other drives obtained by driving a press by an individual motor, are positive and easily manipulated speed control through a wide range, low operating cost, improved cleanliness, greater safety, decided space economy, and in general, much higher plant efficiency.

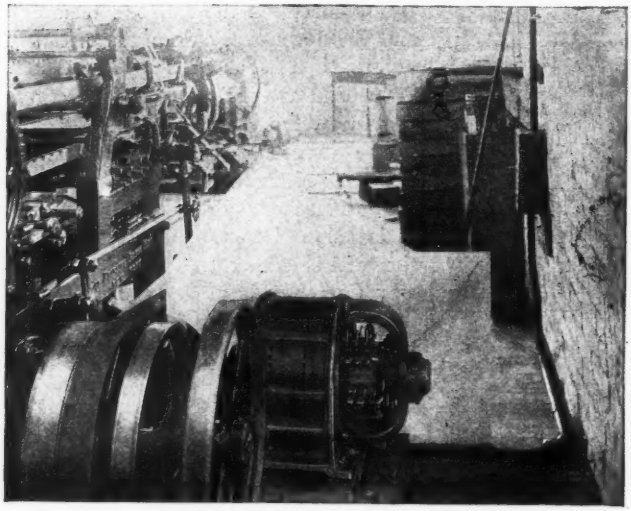
Individual motor drive by General Electric type RI single-phase motors provide all these advantages. RI motors can be furnished with controllers to give a variation of fifty per cent below synchronous speed with uniform and rapid acceleration and deceleration. The performance of both motors and controllers in actual service has proven them to be in every respect entirely satisfactory.



ARRANGEMENT OF GENERAL ELECTRIC CONTROLLER AND RESISTANCE ON BABCOCK OPTIMUS PRESS.



VARIABLE-SPEED, ONE-HALF-HORSEPOWER, SINGLE-PHASE MOTORS DRIVING JOB PRESSES.



TWO-HORSEPOWER VARIABLE-SPEED MOTOR ARRANGED FOR BELTED INDIVIDUAL DRIVE OF OPTIMUS PRESS.

GENERAL VIEW OF PRESS ROOM WITH PRESSES DRIVEN BY GENERAL ELECTRIC SINGLE-PHASE, TYPE RI MOTOR.

An installation of General Electric motors in the plant of a well known job-printing establishment in Warren, Pa., illustrates very forcibly the adaptability of the RI motor to this class of work.

The printing plant in question at first operated its press equipment by means of a six horsepower gas engine. Due, however, to frequent shut-downs and generally unsatisfactory operations, the engine was replaced by a six horsepower direct-current motor. The improvement in service was so marked that in order to secure the added advantages of the individual drive in regard to speed control, etc., the proprietors decided to adopt still further refinements and so installed one General Electric type RI motor to separately drive each of the five presses in use, as well as one stitcher. The final arrangement with individual drive brought about such marked improvements in re-

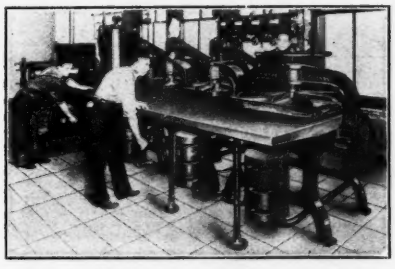
gard to cleanliness, noise, operating costs, etc., that the owner was very well pleased. In a recent letter alluding to the installation, the owner of the establishment wrote as follows:

"The flexibility of the motor drive makes it possible to get out better and more work at a very low power cost. The motors are little beauties and run like a charm. It is certainly surprising how much lighter, cleaner and quieter my plant is now than with the old shafting."

The Wesel-Westinghouse Electric Matrix Drying Table.

In the daily race against time in the newspaper office, during the last hurried minutes before the paper is put to press, no appliance recently added to the printing-plant equipment has worked such improvement in speed, reliability, convenience and cleanliness as the electric matrix-drying table.

With it, "mats" are dried in one-half to one-third the time required by older methods. The close control of the electric heat enables the temperature to be



ELECTRIC MATRIX-DRYING TABLE.

held accurately at the desired point. The controllers are mounted on brackets beneath the bed of the machine, convenient of access to the workman. A very large number of temperature gradations is available. The temperature is shown by an electrical thermometer, the indicator of which is mounted upon an adjacent wall or firm support.

The superior economy of electric matrix driers over those heated by steam, gas or other means, lies in the possibility of applying the heat directly to the work, the other parts of the bed being thoroughly insulated against radiation and conduction losses. As a result of this isolation of the heating element, the temperature of the stereotyping room is much reduced, and since its atmosphere is not devitalized from supporting combustion as with the gas-heated table, an improvement in the comfort, health and work of the operators has been many times demonstrated as the result of the electric matrix drier.

Combined with the greater pressure possible with the use of compressed air supplanting the effort of the hand-wheel, the high temperature of the electric hot-bed results in the production of matrices of greater sharpness and depth, and of superior printing quality. As noted before, the time of drying can be cut to one-half that of any other process, the actual amount depending, of course, on the quality of the work to be done. It is possible, however, to thoroughly "bone-dry" a matrix in less than two minutes, a speed of operation before considered impossible.

These electrically heated matrix-drying tables, for hand or compressed-air pressure, as manufactured by the F. Wesel Company, 70-80 Cranberry Street, Brooklyn, N. Y., employ the well-known Westinghouse heating elements. They are in the service of some of the most progressive newspapers of the country, and have greatly improved the conditions usually found in the stereotyping rooms, besides affecting an important saving in the time of preparing the plates for the various editions. The resistance used has proven thoroughly reliable and permanent, and the expense of electrical operation with the Westinghouse heating element is unquestionably lower than by any other method.

For use where the element of time is not so important in drying the matrix, a slower type of heating bed is supplied. Complete with heating elements, this bed is only two inches in thickness and is designed to be placed directly on the steam-heated bed, making a convenient source of heat quickly available without the delay or difficulty of resorting to steam heat. These electric beds for slow drying perform their service in about the same time as the gas or steam heated beds, and with the same economy of the quick-drying unit.

Swedish Telegraph Board Purchases Long-Distance Telephone System.

A Swedish correspondent states that the Swedish Board of Telegraph Commissioners has purchased for the sum of 25,000 kroner (about $6,700) the Egnér and Holmström long-distance telephone, which has already been mentioned in these columns. The workable radius of this invention is said to be between 3,000 and 4,000 kilometres.

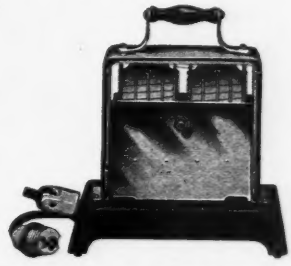
New Type of Electric Toaster.

In the accompanying illustration is shown a new type of electric breakfast room toaster being placed on the market by the Simplex Electric Heating Company, Cambridge, Mass.

This toaster has a polished metal case, in the center of which an upright electric heater extends from end to end. On each side is a door which swings outward and downward and opening sufficiently to permit the placing or removal of bread without chance of burning the fingers. When toasting the doors are closed, confining all the heat within.

A flexible conductor is provided with a lamp socket plug and another plug by which the current may be turned on or off at the toaster. The walls of the casing are double with an air space between. All the interior surfaces are brightly polished providing heat reflectors.

The construction is thoroughly substantial, there being no delicate parts or soldered joints. In operation any



NEW SIMPLEX ELECTRIC TOASTER.

crumbs from the bread fall within the enclosure of the walls and doors on the porcelain enameled base and are easily disposed of by opening the door.

The walls and doors are smoothly polished, with ebony finished handles and the plating is finished in either nickel or silver.

The five points claimed by the manufacturers as emphasizing the value of this toaster may be stated as follows: Convenience and comfortable operation; rapid toasting with high economy; simplicity and durability; accessibility and cleanliness and best of finish in good form.

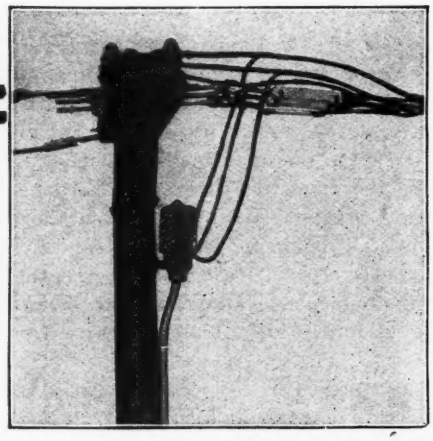
An Electric Pump for Motor Tires.

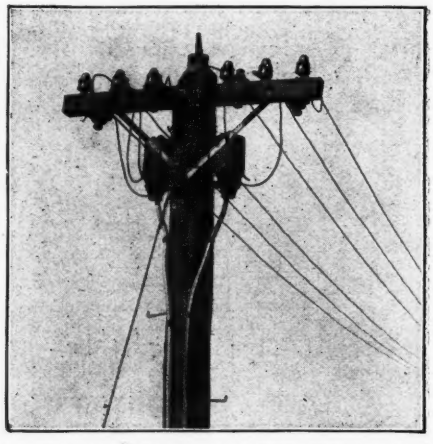
An electric pump for inflating motor tires has recently been introduced by E. E. Coy, of Liverpool, England. This is claimed to be one of the essentially useful labor and time saving devices of the up-to-date garage.

An All-Porcelain Pothead.

The Colonial Sign and Insulator Company, of Akron, Ohio, will soon place on the market a new type of overhead high-tension cable terminal box or "pothead." This device was developed for the Cleveland Electric Illuminating Company by E. E. Noble, its superintendent of construction, and has been used by this company to the exclusion of all other types for the past year. The illustrations herewith show actual installations on this company's 2,300-volt lines. To determine the reliability of this type of pothead, however, certain of them were mounted and subjected by the company's engineers to continuous tests under actual service conditions on voltages from 6,600 to 13,200 for a period of eight months with most gratifying results. A laboratory test showed that the current would arc from one terminal to another at 30,000 volts, but no breakdown ensued.

ALL-PORCELAIN POTHEAD WITH COVER BELL REMOVED.





INSTALLATIONS IN CLEVELAND, OHIO, OF ALL-PORCELAIN POTHEADS, AT JUNCTIONS OF THREE-PHASE CABLES AND OVERHEAD LINES.

These potheads are made of brown glazed porcelain, the only metal parts being the terminal contact blocks and the supporting clamp ring. As seen from one of the illustrations and pothead consists of peculiarly shaped body and a suitable cover bell. The cable enters the neck of the body or pothead proper, and the conductors separate within this neck and are brought out and screwed into the contact blocks through the slots provided. Barriers between the phases prevent creeping and short-circuiting. The overhead leads are led up into the contact blocks through notches in the cover so as to form a natural drip loop.

When paper-insulated cables are used, as is the case in Cleveland, the insulation is protected by a wrapping of varnished cambric tape or of splicing gum tape served with P. & B. paint. This is made to extend somewhat below the end of the lead sheath.

The body is fitted with a lug and the clamp with a socket to prevent the pothead from turning, and the cover bell with lugs between which the barriers of the body engage in order to locate the lead openings in a definite position with reference to the conductor slots in the body.

Some of the advantages claimed for this pothead are its simplicity, compactness, lightness, ruggedness, neatness and its low cost. The removable cover bell permits of rapid inspection, the screw connections in the contact block of quick disconnection for tests or other purposes. The manner of bringing in cable and leads prevents the ingress of moisture. The cable sheath does not have to be wiped on to the body and its outer diameter is immaterial as long as it will enter into the neck.

The only compound used in the pothead is about a half teacupful of ozite or similar high-grade insulation which is filled into a small pocket formed at the top into which the bolts holding the terminal blocks converge. Absolutely no compound is required to protect the end of the cable.

The type illustrated weighs about eighteen pounds, complete and was designed for three-phase, 2,500-volt circuits, but has been found to operate successfully on 6,600 volts and will take cables up to one and seven-eighths inch outside diameter. Potheads for single, two or three-phase service and for higher voltage or larger diameter cables can also be supplied in this type.

New Type of Tailor's Goose.

The steadily increasing use of electrical devices in industries is constantly creating a demand for improved appliances and in no field has the demand been more insistent than for an electric iron for use in tailor shops.

The requirements of a tailor's iron are more exacting than are those of other irons and the faults more or less common to the majority of electric irons are therefore more conspicuous in the tailor's iron.

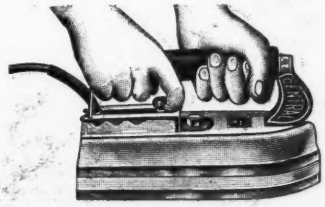
If high efficiency is desired in the smaller types, it is even more so in tailors' irons, because the large area of the bottom requires a greater volume of heat and they are used a longer number of hours than are most smaller irons. It will therefore be seen that the quantity of energy required to do a given work becomes, for tailor's irons, no small matter.

It is perhaps the factor of endurance, however, more than anything else which has eliminated the average electric iron from most tailor shops, for as a rule it has a shorter life than other weight irons of the same design. There are two reasons for this: First, because the nature of the work requires a larger volume of heat and much higher temperature. Second, because of the inherently slow starting ability and the intermittent nature of the work there is more temptation to let the iron stand with the current on, in order that the iron be ready for use. The first of these makes it necessary to wind the heating element for excessively high temperature, and the second increases the danger of burn-out still further.

With a full knowledge of the conditions to be met the Central Electric Company, Chicago, Ill., has placed on

the market the Universal tailor's goose illustrated herewith. This new iron is simply a development of its well-known four and six-pound irons with the necessary changes in design to meet the necessary conditions imposed by the severe service met in tailor shops. A prominent feature of the new iron is the three-heat switch-plug by which all heats can be controlled by a simple motion of the hand while ironing.

This desirable feature is accomplished without withdrawing any plug from the iron, or turning any auxiliary switch. The heating elements are so arranged that the heat is distributed over the bottom of the iron equally correct at any one of the three heats, and at the same time maintaining an equally high efficiency on any of the heats.



CENTRAL ELECTRIC TAILOR'S GOOSE.

The advantages of the new Universal tailor's iron possessing three heats, which can be controlled with a simple movement, are two-fold: First, it gives a greater range of control of temperature than can be obtained by ordinary switch-plug, or by other means. Second, the low heat can be so arranged that the quantity of current consumed will just maintain the iron at a temperature while standing indefinitely.

The first advantage is appreciated by manufacturers who have special temperature requirements and where the nature of the work varies greatly. The second is more important in job shops where an iron is more liable to burn out, as this feature would prevent such by allowing it to stand at low heat instead of high.

This is an important feature as the iron is always maintained at just the correct temperature while standing between jobs and does not cool off or get any hotter. This enables the operator to pick up the iron and go ahead any time without waiting, whereas should the full heat be left on, leaving out the question of consumption, it would become too hot. The medium heat is used only when very light work is to be done, or where only one piece is to be pressed.

A Department Store Pneumatic Cash System and Motor Equipment.

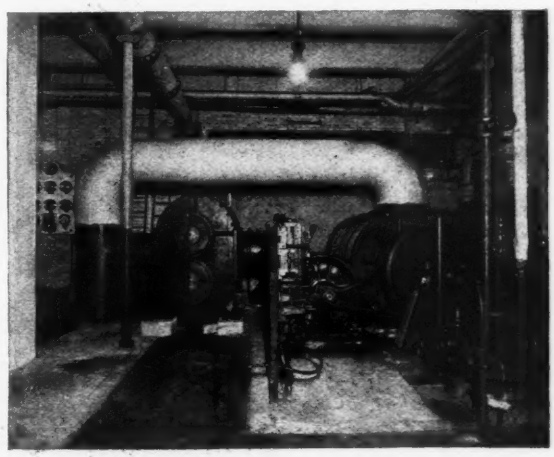
In a modern department store the rapidity with which change is made and charges entered is of the utmost importance. Although a customer may need an hour to decide upon a purchase, if a few minutes are required by the cash office to properly handle the cash or credits, this time is, in the customer's mind, added to the time already spent and the whole is charged against the store's service. The management must have changes made in such a short time that the customer may leave before having the chance to think about the time spent, and, therefore, goes away with an impression of good service.

Boggs & Buhl, North Side, Pittsburg, have recently placed in operation, in their department store, a system which is proving very satisfactory. The store has approximately seven acres of floor space, and it is estimated that there is over three miles of cash tubing. Change is made in an average time, for all stations, of from one to two minutes.

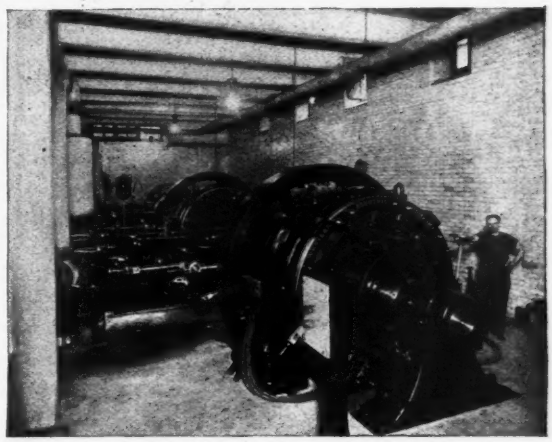
The system which was installed by the Lamson Consolidated Store Service Company is known as an independent vacuum pneumatic-tube system. There are eighty-four lines in operation, seventy-three of which are for cash and the remaining seven take care of the charges.

The cash office, a partial view of which is shown in one of the accompanying illustrations, is located in the basement, under about the center of the building. From eighteen to twenty-four cashiers, of whom four or five are at the charge desks, are employed to handle the business. Each cashier operates from five to seven lines, a space of about twelve inches separating the banks of tubes assigned the operators. The charge desks are located in the center of the cash office. The charge lines, or tubes, branch off from here to the various points, so located that there is one charge station between every two cashiers. This arrangement brings the regular cashier into close touch with those who enter the charges. The charge desks are also connected by tubes with the general offices on the fifth and the credit office on the first floor.

Each of the eighty-four salesmen's stations uses, on an average, six cash and four charge carriers. This equipment has proven sufficiently large to handle satisfactorily the firm's business.



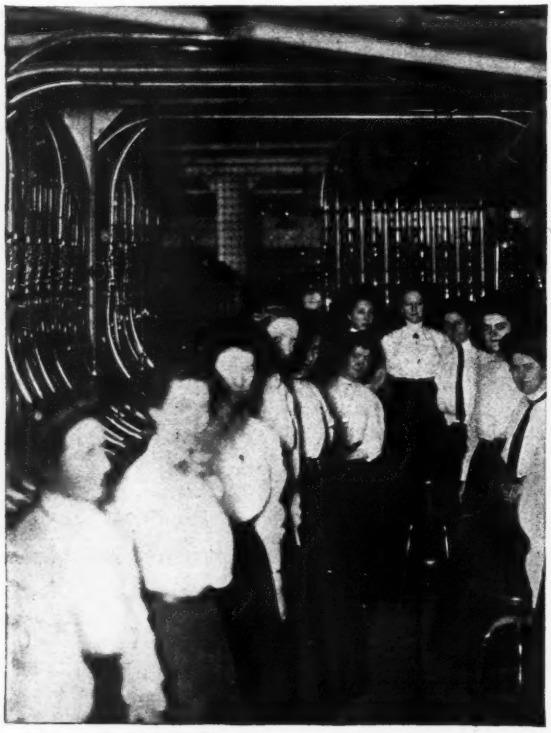
VIEW OF BLOWERS IN POWER PLANT.



VIEW OF POWER PLANT SHOWING DIRECT-CONNECTED UNITS.

The power to operate this system is furnished by two Root blowers chain-driven by Western Electric fifty and fifty-five horsepower motors. The blower with the motor shown at the right of the accompanying illustration is the larger of the two. The machine at the left of the same cut is the smaller of the two blowers, and is used for emergencies only. The starter for the motor of the first set is seen in the center foreground.

The power for operating the blower motor is obtained from a 110-volt direct-current circuit, which leads from the new power plant just installed in the basement of the latest addition to the building. A view of a portion of the engine room, showing two of the three direct-connected Western Electric generators, is also shown. The whole plant is of the latest design, and is a model for cleanliness.



VIEW OF CASH OFFICE IN PITTSBURG DEPARTMENT STORE.

The power plant of this store is of 750-kilowatts output. Power is used to operate the previously described cash system, 500 arc and 2,000 incandescent lamps, eleven elevators, a vacuum cleaning system for the store, a twenty-ton refrigerating plant for cold storage, drinking water and soda fountain, and thirty-eight motors of various sizes, operating sewing machines, carpet machines, saws, dictaphones, adding machines, fans, etc. Probably the most novel application is a motor driving and air compressor, which furnishes air to a tap on the street corner, where automobile owners may pump up their tires. This application is proving a good advertising medium.

Wireless in Australia.

The Australian Government has appropriated $50,000 to establish wireless stations around the coast of Australia.

The Federal Vacuum Cleaner.

The Federal Electric Company, Chicago, Ill., is placing on the market a new type of electric vacuum cleaner which is particularly adapted to residence, office building, church, library, hospital, hotel and theatre cleaning purposes. These cleaners, shown in the accompanying illustrations, have been carefully planned to avoid objectionable features and to perform satisfactorily the work for which they are intended. The cabinet in which the hose and tools are kept is built of mahogany with dull piano finish. It is mounted on two cushion-tired twelve-inch bicycle wheels and a rubber-tired ball bearing caster which makes it easy to move the machine to any part of the house. The large wheels make it particularly easy to move up and down stairs.

FEDERAL VACUUM CLEANER.

The machine can be attached to any lamp socket and can be furnished for either direct or alternating current. The equipment includes fifteen feet of vacuum hose and twenty feet of lamp cord, which, with the extension handles, gives a radius of action of forty feet from the lamp socket.

The Federal cleaner is equipped with a rotary pump connected directly to a one-quarter horsepower motor, insuring a steady vacuum in the simplest manner. The construction is such that the necessity of carrying or lifting it is eliminated. The motor and pump are made into a single unit by means of a direct connecting device which eliminates vibration and minimizes noise.

We have shown herewith an illustration of the Federal vacuum cleaner in operation cleaning stairs. The manufacturers have designed for this purpose a special tool which fits snugly over the stair edge, preventing loss of vacuum and effectively removing every vestige of dust, both in and beneath the carpet.

FEDERAL VACUUM CLEANER WITH STAIR-CLEANING TOOL.

This cleaner is supplied with necessary tools for cleaning carpets and rugs, draperies and curtains, furniture, hardwood floors or walls.

To Lease Waterpower Sites.

In his recent annual report, Secretary of the Interior Richard A. Ballinger recommends that waterpower sites on public lands still undisposed of, should not be sold outright, but leased for periods up to and not exceeding a maximum of at least thirty years. Mr. Ballinger gives details of his tentative plan in which he proposes that taxes for rent be assessed on the capital invested or on the gross earnings of the plant.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 26.—The old question of electric-lighting tariffs was once again discussed at the Institution of Electrical Engineers last night. The matter was raised in a paper by Messrs. Handcock and Dykes in which it was proposed to deal with the small consumer, from which the gas companies derive so much revenue, by the abolition of meters and charging a fixed charge per thirty-watt lamp per annum for an all-day supply, and a smaller fixed charge when the supply is given from "dusk to dawn." The prices suggested as an average were $3 and $2.50 respectively. In order to insure that consumers upon this system shall not change the size of their "contracted" lamps, for lamps of higher candlepower, it is proposed to adopt a special form of holder to the lamps which will only be supplied by the supply authority. A similar system to this has actually been in operation in Harrogate (Yorkshire, England) for a good while, with very satisfactory results, although it is admitted that the total revenue from consumers is under ordinary tariffs. It includes the wiring, however, and there are no meter rents, and it seems that consumers prefer to know exactly what they have to pay. At the same time there is a wide divergence of opinion upon this question, but it is more than probable that the system proposed, or a modification of it, will be tried in many of the smaller towns. There is also some difference of opinion as to whether metal-filament lamps should be used with low-tension or high-tension supply, i. e., twenty-five volts, or the higher voltages in vogue with carbon-filament lamps, and in view of the multiplicity of voltages in use in England today, the suggestion made in the discussion that some steps should be taken towards securing uniformity of voltage throughout the country seems an eminently sensible one.

The Local Government Board has taken the drastic course of refusing a loan to the Finchley (North London) Council for street electric lighting for the reason that the board has not been furnished with comparative figures of the cost of gas lighting. The council took the position that it formed no part of the functions of the board to dictate as to what system of lighting should be adopted. Having an electrical undertaking they considered it their duty to have electric light in the streets. This scheme has already been put in hand and will now have to be paid for out of revenue or met by a special charge upon the rates. The case serves to indicate the attitude which the Local Government Board is taking up in connection with loans for electrical purposes. A similar refusal was made a short time ago in the case of the Marylebone council for a street lighting scheme. In this instance, too, the cost was defrayed out of revenue.

The action of the Welsbach Incandescent Gas Company in putting a tungsten lamp upon the market in competition with the agents in Great Britain of the German Welsbach Company, will very likely lead to a patent infringement action concerning the validity of the patents under which the Welsbach Company's lamps are made. Although called "Welsbach Aur" lamps, it is now known that they are made in Berlin and are in no sense the invention or product of the English Welsbach Company which sells them. The complaint of the General Electric Company here, is that Baron Welsbach should have placed upon the market a metal-filament lamp in competition with the product of his own German company. The police-court proceedings under the Merchandise Marks Act in which the charge is that the lamps have a false trade description, are still going on and likely to for some time yet, but the result in any event may lead to a patent infringement action as already mentioned.

The postmaster-general still finds it very difficult to get over the prejudices of local authorities around London against the use of overhead wires for telegraph and telephone purposes. Because, for obvious reasons, all the wires in the center of London were placed underground at great expense, all the outside authorities seem to regard this as a good argument for resisting the erection of overhead wires in their districts. In hardly a single case are they successful and much of the ratepayers' money is thus wasted in legal fees. The latest example of this kind was decided this week against the Hammersmith Borough Council the postmaster-general's argument that cheapness of service could not be maintained if an expensive underground system had to be installed, gaining the day. A similar position was taken up by the London local authorities in regard to tramways, because the conduit system was installed in the central portions of the metropolis. This prejudice, however, is gradually disappearing.

It is significant that although the London County Council has disposed of its Works Department, a considerable quantity of work is still being carried out by direct labor in the tramways department. Top roofs have been added to fifty double-deck cars by this means and a further ninety cars are also to be dealt with. In addition, it has just been decided to have plows fitted to 200 new cars by a contractor.

Wednesday, next, December 1, is now definitely decided upon as the opening day of the single-phase railway in South London. The management has given it the distinctive name of South London Elevated Railway, and in addition to a very much accelerated service, extensive reductions of fares are announced.

To judge from the preliminary announcements of bills to be promoted in the next session of Parliament there are to be no powers requested for important constructive works. Further linking up of the tube railways in London is proposed, in addition to the amalgamation of the three tube railways affiliated to the District Railway. Several municipal corporations will apply for powers to run trackless-trolley cars, but the new tramways proposed are not very extensive. The Board of Trade will promote a bill authorizing the London County Council to purchase the five "West End" electric supply companies of London, who were for some reason left out of the London Electric Supply Act of 1908 when all the other London companies were placed in this position. A new tube railway from the city to the Crystal Palace has been postponed for the present.

It is stated that an application will shortly be made for an extension of the Marconi fundamental patent of 1896, which normally expires in June of next year. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 26.—Among recent electrical projects in France, I note that the Lyons Gas Company is making negotiations for supplying current for the town of Bourg. It is likely that the commune of Figeac will receive a light and power supply from the electric plant which is now in operation at Capdanac. The town of Mer is about to install an electric lighting plant, as also the localities of Montfermeil and Jarnac.

An electric railroad line is soon to be opened for traffic in the south of France. It lies in the Pyrenees region and will eventually make connection across the frontier with the Spanish railroad lines leading to Barcelona. The present railroad is the first standard gauge electric line to be operated as part of the Southern Railroad System, which is one of the leading railroads in France. It runs from Villefranche by way of Vernet to Mont Louis, and it is intended to extend the line from the latter point as far as Bourg-Madame so as to connect with the Spanish lines. The present railroad, although but eighteen miles in length, is remarkable for the fact that it passes through a mountainous region and runs for the most part in cuttings on the mountain side, viaducts and bridges. The road mounts up from 427 to 1,510 meters altitude, which makes the gradients high. The Gisclar bridge is suspended eighty meters above the mountain torrent of the Tet, and is a remarkable work. Current for the railroad is supplied from the Cassagne electric plant, and it is operated on the third rail system.

The town of Schaerbech, Belgium, is taking measures to erect a garbage consuming and electric plant, finding this to be the best means of securing the current supply which is needed. A prominent fertilizer company has promised to take all the products from the furnaces.

In Spain negotiations are under way for the construction of an electric traction line which is to run between the communes of Avanzada and Algorta.

Budweis, Austria, will probably have a narrow gauge electric line running through the town in different sections, these to connect with the railway depots. The lines are to be run on the trolley system. A. DE. C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., DECEMBER 4.—A wireless system of signals, for the running of railway trains, will be installed on the Canadian Pacific Railway between North Parkdale and West Toronto. If the test is a success, there is every indication that this system will be adopted by the company.

The Quebec Railway, Light, Heat and Power Company, the recent big electric merger in Quebec, has made a very successful issue of its securities. It is stated that the underwriting has been over-subscribed by nearly one hundred per cent, and that there will be no public issue of the stock.

With the successful commercial experiments, recently made in the Dominion, in converting bog peat into fuel for heat, light, pro-

ducer gas and electrical energy, the 370,000 acres of Ontario peat bogs, which average nine feet deep, will be largely used as a substitute for coal in this province. Ontario's coal supply now largely comes from the United States.

The capital required for the construction of the Ottawa & St. Lawrence Electric Railway, has been oversubscribed by English investors, and there seems now no reason why the work should not be proceeded with at once. As required by the charter, work has to start not later than May 15, 1910, and 254 miles of the railway must be finished within two years.

After a long and stubborn fight, in the council and the courts, the city council of Hamilton, Ont., has decided to enter into a contract with the hydroelectric commission for 1,000 horsepower on the terms submitted by the commission. It is three years since the contract was first submitted to the people and on two occasions since that time, the bylaws were indorsed.

Within a radius of eight miles of Ottawa are undeveloped waterpowers amounting to 200,000 horsepower, and within a radius of forty-five miles of the city the amount is estimated at 917,400 horsepower. Of this vast amount only 58,400 horsepower is, at present, in use. Just now, electric power can be purchased here for less than $15 per horsepower per annum, continuous service. A new company, which is seeking a charter from the city, has agreed to sell electrical energy at $11 per horsepower. Another use, to which the electric power will soon be put, will be in the development of the mines in the vicinity of Ottawa, by means of the electric furnace for smelting, there being rich deposits of iron ore within a mile or two of immense waterpowers. It will also be employed in the development of the deposits of zinc, plumbago, mica, phosphate of lime, etc., which as yet have not been properly exploited owing to the great cost of fuel.

The Hydroelectric Commission is not going to pay any attention to the Port Arthur injunction, as far as actual work in constructing transmission lines, power stations, etc., is concerned. It will, of course, be obeyed so far as entering into any agreement with the city is concerned. The work of constructing the power line from Kakabeka Falls to Port Arthur and the transformer station will be proceeded with at once. Port Arthur has twice adopted a bylaw in favor of the contract with the hydroelectric commission, but has twice been stopped by technicalities. The contract of the city with the Ontario, Michigan Power Company expires in March, and unless an agreement can be reached before that time the city will be compelled to sign an interim agreement with the company.

The bill of the Montreal Central Terminal Company, asking for the right to enter into combination and acquire certain franchises has been given a first reading in the Canadian parliament. The company asks to be authorized to enter into agreements with the following railways: The Canadian Northern, the Ottawa Valley, the Boston & Maine, the Intercolonial, the Montreal Terminal, the Montreal Suburban and Chateauguay and Northern railways; to acquire the franchises, rights and properities of the Montreal Light, Heat and Power Company, the Saguenay Company and the Canadian Light Company, and to connect its telegraph and telephone lines with existing companies. The company is to begin its works and expend $500,000 within two years, and if not finished in seven years, its powers will lapse. W.

LIGHTING AND POWER.

(Special Correspondence.)

HETTINGER, N. D.—C. A. Meyer, of Clarkfield, Minn., is about to put in an electric-light plant here. P.

EARLHAM, IA.—Work has been started on the erection of an electric light plant and waterworks system. C.

WATERTOWN, S. D.—The Ferris Brothers System is having plans drawn for a light and power plant. C.

LONG BEACH, CAL.—The Long Beach Electric Company has been incorporated with a capital stock of $10,000.

BRIDGEWATER, S. D.—A. M. Weidenbach, of this city, has been granted a twenty-year electric-light franchise. P.

MARENGO, IA.—The Marengo Electric Light and Power Company has been incorporated with a capital stock of $15,000.

RAMONA, S. D.—The Citizens Light and Power Company has let the contract for a $2,000 plant to H. P. Mortensen, of Toronto, S. D.

DUNSEITH, N. D.—John Gottbrecht will commence the construction of an electric light and waterpower plant at Mineral Springs in the spring. C.

PARK RAPIDS, MINN.—The dam of the Park Rapids Power and Light Company is going out. The damage will amount to many thousands of dollars. C.

UPLAND, IND.—The Town Council is preparing to let a contract for the construction and equipment of a combined waterworks and electric-light plant. S.

TACOMA, WASH.—It is expected that the council will shortly call for bids for the construction of the first unit of the $2,000,000 power plant on the Nisqually River.

RAMONA, S. D.—The contract has been let for the construction of an electric light plant, complete with wire, poles, switchboard, dynamo, engine, belting, etc., for $2,000.

COUDERAY, WIS.—The Arpin Lumber Company, of Grand Rapids, Wis., is constructing a water power and concrete dam across the Chippewa River, seven miles below here. C,

TWIN BRIDGES, MONT.—The Madison River Power Company is erecting a dam at the site for the powerhouse on the Madison River in the upper part of the Madison Valley. C.

KALISPELL, MONT.—C. A. Farrar and others have incorporated the Bitter Root Mountain Water Power Company, with a capital of $100,000, to develop more electricity in the Flathead Valley. C.

HAZLETON, PA.—The Harwood Electric Company is extending its transmission line from this city to Berwick through Nuremberg, Derringer and Tomhicken. It is probable that the line will also be run from Tomhicken to Conyngham.

PRESCOTT, ARIZ.—The Prescott Electric Light Company has closed a contract with the Arizona Power Company which has a hydroelectric plant at Fossil Creek. The lighting company is to receive 600 horsepower, which will be distributed by them to their customers.

SALINAS, CAL.—The Monterey County Gas and Electric Company has recently been changed from a two-phase, four-wire system to a three-phase, three-wire system. Power is now transmitted at 2,200 volts and transformed to 220 or 110 volts for power and lighting circuits.

TOMAH, WIS.—The Goodyear Lumber Company has completed at Tomah what is stated to be the first electric sawmill in the country. August H. Meyer, of Appleton, Wis., prepared the plans for the mill and directed its construction. It has a daily capacity of 100,000 feet. M.

GREENFIELD, IND.—The Citizens' Electric Company, of Hancock County, has been incorporated, with a capital of $10,000. The company proposes to erect, maintain and operate a pole line transmission system to furnish current for light and power to the rural citizens of Hancock County. E. M. Leary, R. F. Morgan and John S. Thomas, directors. S.

JACKSON, GA.—The work of constructing power transmission lines of the Central Georgia Power Company has begun, it is reported. The first line will be run from the power plant on the Ocmulgee River, near here, to Macon, Ga., going via Bibb and Forsyth, Ga. It has been stated that a line will also be built from Forsyth to Griffin, Ga., and thence to Atlanta, Ga. B.

REXBURG, IDAHO—A deal has been closed whereby the Idaho Power and Transportation Company, of Idaho Falls, has purchased the electric-light and power plants at Rexburg, Sugar City, Teton City and St. Anthony. These plants belonged to the Hodgens Brothers, of Butte. The deal also includes the water system of St. Anthony and represents a total value of $150,000. These two companies have been competitors in Rexburg and St. Anthony. The headquarters of the company will be retained at Idaho Falls.

ALBEMARLE, N. C.—Local cotton mills have closed a contract with the Southern Power Company for current to be used as the motive power in operating several large textile mills here, this station being on one of the main transmission lines, carrying 80,000 voltage. The town recently voted in favor of electric lighting bonds, and now it is possible that a municipal contract will be drawn up and entered into with the Southern Power Company to supply the necessary current. The matter will reach definite shape in a short time. L.

FT. WAYNE, IND.—The first annual report of the Ft. Wayne Municipal Lighting Plant shows that the cost of maintaining and operating the plant from and including September, 1908, until February, 1909, is $12,273.10. After February 1, the plant had monthly receipts from commercial lighting in addition to receipts for street lighting at $53 per arc lamp which totaled $20,285.91. The total expenditure amounted to $18,164.88, leaving a balance of $2,121.03. The total cost of the plant amounted to $165,254.10, to which $25,000.00 has been added for extending the lighting lines and installing commercial service. S.

SALT LAKE CITY, UTAH—H. E. Smith, of Duluth, Minn., has filed application for 100 cubic feet of water per second from the Sevier River in Piute County. The application states that the diverting works will consist of a dam about sixteen feet high across Sevier River and that the diverting channel will be 42,000 feet long. In the power plant 72-inch Pelton wheels will be used, operating under a head of 330 feet and generating a total of 1,500 horsepower. The electrical power thus generated will be used in electric lighting and propelling machinery in Marysvale, Kimberly, Richfield, Milford, Frisco, Sevier and intermediate points.

MADISON, WIS.—The wholesale removal of poles and wires from several Madison streets has been ordered by the City Council. This work must be done by August 10, 1910, and failure to do so by that time will make the utility companies liable to a fine of $10 to $100 a day for each day after Aug. 10, 1910, until it is done. The Southern Wisconsin Traction Company also has been ordered to erect iron trolley poles on State Street and University, a total distance of twelve blocks, in place of the present wooden poles. This work must be done within six months. A penalty of $10 to $100 for each day after the time limit is provided for if the poles are not replaced as ordered. M.

SIOUX CITY, IOWA—A vote will be taken December 21 on granting franchises to the Sioux City Gas and Electric Company and the Sioux City Service Company to operate an electric-light and power and gas plant. C.

ROANOKE, IND.—This city has closed a contract with the Fort Wayne & Wabash Valley Traction Company for the lighting of the town by electricity and is now laying plans for the erection of electric arches on the main street.

WILLIAMSON, W. VA.—Captain E. L. Bailey has applied for a franchise to install and operate a light plant at his mines, and incidentally to light this city. Mr. Bailey is now using power from the Williamson Light and Ice Company.

GOLDFIELD, NEV.—A. J. Trumbo, general manager of the New Bonnie Clara Mining Company, has closed contracts with the Nevada-California Power Company for electric power for the mill at Bonnie Clara, and a line will be extended at once. A.

LEWISTOWN, MONT.—The Spring Creek Power and Electric Company, organized by John L. Bright, has been incorporated with a capital stock of $1,000,000, to engage in the light and power business, construct dams, electric railways, power plants, etc. C.

MARBLEHEAD, MASS.—Work on a municipal lighting plant is to be begun at once, so that the lighting may all be taken care of by next summer. The committee on reconstruction elected William A. Brown as chairman and Joseph Coates as secretary.

FULTON, KY.—The Swain-Karmire mill is preparing to install a private electric-light plant at their big mill on the Tennessee side. The plant will furnish illumination for the mill and lumber yards. The engine and dynamo have arrived. Electrician J. W. Stitts will install the plant.

CITY OF MEXICO, MEX.—The Guanajuato Power and Electric Company is preparing to transmit electric power to Aguas Calientes, where the American Smelting and Refining Company's smelter is located. Power will also be delivered to the Asientos and Tepezala mining districts. A.

BOISE, IDAHO—The power site located on the Snake River between Garnet and Henry's Ferry has been withdrawn from entry. If the withdrawal stands this land will not be issued to settlers, but will be improved by the government. The power site is in the big bend north of Bruneau, and is quite valuable.

MUNCIE, IND.—In consideration of $225,000 the Muncie Gas, Light and Fuel Company's property was sold November 26 to N. W. Harris & Company, a well-known bonding company of Chicago. Robert O. Lord represented the purchaser and the sale was made by Edward Daniels, master in chancery of the Federal Court. S.

LINTON, IND.—Because the city council had not fully complied with the law in the proffered sale of the Linton municipal light plant, the court refused to ratify the sale. The council will again offer the plant for sale. There are a number of bidders and the successful bidder will, of necessity, have to improve the plant. S.

DARLINGTON, S. C.—A charter has been issued to the Darlington Water and Electric Company, who have incorporated for the purpose of constructing a general lighting and power business. The officers are as follows: President, A. P. Malone; vice-president, W. H. Haynesworth; secretary, L. C. Ritchie. The capital of the company is $50,000.

ALBEMARLE, N. C.—The cotton mills have just closed a contract with the Southern Power Company for the running of all their machinery, and a substation will be established here. Albemarle is on the main line of the Southern Power Company, which extends from the power plant on the Catawba River to Salisbury. This line carries about 80,000 volts. The city may also be lighted with power from the company.

NATCHEZ, MISS.—The generators for the Southern Railway and Light Company plant have been received, and are being installed. One is a 300-kilowatt generator for the alternating current or private lighting service and the other is a 300-kilowatt direct-current generator for the street railway. The 500-horsepower boiler has been installed, and when the new generators have been placed in position the company will be prepared to handled a much larger service than the present demand calls for.

SACRAMENTO, CAL.—The Rubicon Water and Power Company is putting up several buildings at the intake of the ditch, on the Rubicon River. Men will be kept at work by the company all winter, driving tunnel and doing such other work as the weather will permit. The company has seventeen miles of ditch surveyed. There will be four tunnels, altogether five miles in length, through which the water will flow, and the amount of water controlled at the completion of the project will enable the company to generate 30,000 horsepower.

EVANSVILLE, IND.—A franchise has been applied for by the Evansville Public Service Company, recently organized, to build, equip and operate a central electric-light, power, steam and hot water plant in this city. The company proposes to reduce the price of electricity to seven and one-half cents a kilowatt—a reduction of twenty-five per cent of the price now charged. The company agrees to pay to the city fifty per cent of the net earnings of the company after deducting six per cent on the capital stock and four per cent for a repair fund.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SIOUX CITY, IOWA—An interurban line to Mitchell, S. D., is projected by L. F. Phillips, of Wagner, S. D. C.

WINONA, MINN.—The city council denied the petition of the La Crosse and Winona Traction Company for a franchise. C.

SAN DIEGO, CAL.—Bids are now being received for the $1,000,000 car barns which the San Diego Electric Railway Company will erect. A.

HAYWARDS, CAL.—Work will be started in January on the extension of the Oakland Traction Company's Haywards line from this place to Niles. A.

BOISE, IDA.—A survey has just been completed for an electric line from Caldwell to Nampa, which will be built early next spring. The line will cost $150,000.

GLOBE, ARIZ.—The Stone-Webster Company is preparing plans for a street railway in this city, with an extension to Miami and other large mining camps in this vicinity. A.

BILLINGS, MONT.—Geo. H. Kesselsmith and H. F. Pierce are making a preliminary examination for a proposed electric road to Red Lodge, Bear Creek, Fromberg and Bridger. C.

LOS ANGELES, CAL.—An ordinance has been passed granting to the Los Angeles Railway Company the right to construct and operate a double track electric street railway upon certain streets in this city. A.

LOS ANGELES, CAL.—Bids will be received up to December 21 for a franchise for an electric railway commencing at the intersection of Main and Ann Streets and along Ann northwesterly to San Fernando Street. A.

MANKATO, MINN.—Eastern capitalists are behind a plan to build an interurban line to St. Paul and Minneapolis. It is understood that the proposed road will be wholly independent of the Dan Patch line as well as of the Twin City Rapid Transit Company. C.

LA CROSSE, WIS.—The plans of the La Crosse Water Power Company, which owns the Hatfield water power and of which W. J. Ferris is president, provide for a continuous line of modern interurban railways connecting Winona, La Crosse, Sparta, Eau Claire, Chippewa Falls, Menominee, Hudson, St. Paul and Minneapolis. C.

WARSAW, IND.—A mortgage for $1,200,000 in favor of the Carnegie Trust Company has been filed in this county by the Wabash and Northern Indiana Electric Railway Company. The mortgage covers all the company's property in Kosciusko and Wabash County, and this act assures the speedy construction of the road between this city and Wabash. S.

PHILADELPHIA, PA.—Philadelphia and Suburban Railroad Company has fied an application at Harrisburg for a charter to build a subway on Broad Street, Philadelphia, north of the city hall to a point near Cumberland Street. The new plans provide for an extension of the proposed subway system by elevated roads to Fairmont Park, Frankford and Wayne Junction. The original application of the company for a charter to build an elevated road on Twelfth and Thirteenth Streets has been withdrawn.

FT. WAYNE, IND.—As a result of what the directors of the Ft. Wayne and Wabash Valley Traction Company consider unfair treatment, after having spent nearly a million dollars in a monstrous plant, by the city in building and operating a competing plant and putting the price of commercial lighting down to four cents a kilowatt, it has decided to develop the power plants at Huntington and Lafayette expending $250,000 in car barns and repair shops. It was the intention to concentrate all these in Ft. Wayne, but because of the attitude of the city no more money will be expended in Ft. Wayne by the corporation.

SACRAMENTO, CAL.—The directors of the Vallejo Northern electric road, between Sacramento and Vallejo, have filed articles of incorporation. The capitalization of the company is $2,500,000, with $119,000 of the capital stock paid up. From the terminus of the road at Vallejo the route is laid to Napa Junction, Cordelia, Fairfield, Cement, Broderick and to Sacramento. Many branch lines are contemplated, and the country between Sacramento and Vallejo is to be gridironed with trolley tracks by the new company. The directors are Thomas T. C. Gregory, John W. Bauman, William Pierce and Ernest D. Holly, of Suisun, and Winfield R. Madden, of Dixon.

JANESVILLE, WIS.—The Janesville street railway system, perhaps the most dilapidated street car system in the state, owned and operated by the Janesville Street Railway Company, which was controlled by the Bladon estate of Philadelphia, has been sold to New York and Janesville capitalists for about $45,000. The system is to be completely reconstructed. It is rumored that the local lines are to be made a part of the proposed interurban system connecting Madison with Chicago, through Rockford. The present system has a length of five miles. The company's capital stock is $65,000, and the bonded indebtedness $150,000. The new owners will increase the capital stock to $200,000. M.

ABERDEEN, S. D.—The citizens here are raising $120,000 with which to build a street railway system.

OGDEN, UTAH—Secretary H. H. Rolapp, of the Ogden Rapid Transit Company, states that a line is soon to be run to Brigham City.

BILLINGS, MONT.—Geo. H. Kesselsmith and others are proposing to build an electric road from this point to Red Lodge and other points.

TAMA, IOWA—Preliminary work on the Oskaloosa-Tama interurban is being pushed. The right-of-way is being secured and $80,000 has been pledged to build the road. The road can be built for $15,000 a mile.

GUTHRIE, OKLA.—Two interurban roads have been chartered in the last week—Coffeyville to Nowata and Lawton to Fort Sill. Bert Tiloton was incorporator of the former and D. L. Sleeper, of Tulsa, of the latter.

SALEM, ORE.—The Oregon Electric Railway Company has filed articles of incorporation. This railway includes an extension from Salem to Roseburg, a branch to leave the main line between Portland an Tualatin. A.

GAUDALAJARA, MEX.—The State Government has granted a concession to Jas. H. McCreery and Richard Ivey to construct an electric railroad from Magdalena to the Santiago River at a point near Cabrera mine.

NUEVO LAREDO, STATE OF TAMAULIPAS, MEXICO—An electric street-railway system is to be built in the town of Nuevo Laredo by Dr. J. F. de la Garza and associates. Local capital is behind the enterprise.

MEDFORD, ORE.—J. R. Allen, president of the Pacific & Eastern, will apply for a franchise in this city for an electric railroad. Applications for franchises will also be made in all the other cities of the valley. A.

FITCHBURG, MASS.—The Fitchburg & Leominster Street Railway Company is installing a 500-kilowatt generator in its South Fitchburg power station. This will increase the present generator capacity by about sixty per cent.

LONG BEACH, CAL.—As soon as the Daisy Avenue extension of the Wilmington-Long Beach line is finished the Pacific Electric Company will begin work on the four-tracking of the main line between Watt and Dominguez streets. A.

OSKALOOSA, IOWA—It is stated that the $150,000 necessary to construct the ten miles of line of the Oskaloosa-Tama interurban between Montezuma and Malcom has been subscribed and that work will be commenced shortly. C.

WILKES BARRE, PA.—A charter has been granted to the Wilkes Barre Railway Company to operate an electric railway system. The company is capitalized at $10,000. Abram Nesbitt has been elected president, and C. W. Laycock secretary.

FRESNO, CAL.—Construction work is to be begun very soon on the Fresno-Hanford interurban road. This is the first electric line of any prominence in the San Joaquin Valley and it is reported that other electric roads will soon be started.

STUART, IOWA—The interurban roads proposed to be built by the Des Moines, Council Bluffs & Western and the Red Oak, Des Moines & Northern companies will be built only between Des Moines and Stuart and Council Bluffs and Stuart, respectively. C.

MADISON, WIS.—The Southern Wisconsin Railway Company has just received and put into service a new street car costing $3,800. It is much larger than the other cars in use on the lines and has a greater seating capacity. A steel underframe adds much strength to the car. M.

ATLANTIC CITY, N. J.—A trolley line is being considered between Atlantic City and Cape May. J. Fithian Tatem, representing the Suburban Railway Company, which is behind the project, states that it is the company's desire to have the road in operation as soon as possible.

LEBANON, PA.—Charters have been granted for the North Lebanon, the Richland, and the Millcreek Township electric companies, to supply light and power in the sections named. Each company has a capital stock of $5,000. The incorporators are Harry G. Louser, George L. Roller and Harry Hollis.

INDIANAPOLIS, IND.—The Chicago, Blue Island & Joliet Traction Company has borrowed $5,000,000 from the American Trust and Savings Company on forty-year five per cent bonds. It is the intention to improve this property and make it one of the most substantial and perfect trolley lines in the territory through which it passes.

ANDERSON, S. C.—For the sum of $154,750 the property of the Anderson Traction Company has been sold under the hammer to Edwin W. Robertson, of Columbia. The properties include eighteen miles of city and interurban lines, generally estimated as being worth $250,000. The sale was by order of Federal Judge Pritchard, and resulted from the case of the International Trust Company, of Maryland, against the Anderson Traction Company.

MONTICELLO, IND.—The Northern Indiana Traction Company, with headquarters in this city, is making good progress. The right-of-way has been secured and surveyors are setting the stakes and the contract for constructing the road has been awarded to the La Salle Supply and Construction Company, with headquarters in this city also. The company has contracted for the purchase of the Chicago Heights and Eastern Electric road, which will afford terminal facilities into Chicago. S.

APPLETON, WIS.—Appleton and Outagamie County business interests are considering a proposition advanced by A. D. Barnes, president of the Chicago-Wisconsin Valley Railroad Company, for the construction of an interurban railroad from Appleton northward through Hortonville, New London, Waupaca and to Hancock, Waushara County. The proposed line will connect with the line of the Chicago & Wisconsin Valley road at Hancock, and before September, 1911, will be operating an interurban road from Stevens Point to Chicago.

SPRINGFIELD, MO.—The new electric line from Mansfield, on the Memphis division of the Frisco, to Ava, the county seat of Douglas County, was recently opened to traffic. It is the first interurban line to be completed in the Ozark mountain region. Cars operated by storage batteries were put on and will be run until completed passenger coaches can be secured, this step being necessary on the part of the builders of the road to claim the cash bonus and about 100 acres of land offered them by the citizens of Ava.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CHOKIO, MINN.—E. V. Danbenberger and others propose putting in a rural telephone line.

KENMARE, N. D.—The Northern Telephone Company is considering the installation of extensive improvements. C.

NEWTON, IOWA.—The Jasper County Telephone Company will install a new switchboard, with a capacity of 2,400 lines, January 1. C.

NEW LONDON, WIS.—The Wisconsin Telephone Company will expend $14,000 in rebuilding its lines and remodeling its central plant in this city. C.

PARK RIVER, N. D.—John A. Dunn, R. F. Waugh, E. Thornberg and others have incorporated the Park River Telephone Company, with a capital of $20,000. C.

GADSDEN, ALA.—It is stated that the Southern Bell Telephone and Telegraph Company is now connected with the new farmers' telephone line reaching out from Gadesden to Odenville, Ala., and other small localities thereabouts. B

VALDOSTA, GA.—It is authoritatively stated that J. H. Dasher will construct a ten-mile telephone line running out from Valdosta in the direction of Bemiss; connection to be had with the system of the Southern Bell Telephone and Telegraph Company. B.

MOBILE, ALA.—The Rabby Wireless Transmission Company has been incorporated with the Mobile branch's capital stock of $10,000. It is the intention of this company to transmit messages by the wireless system to Montgomery, and other nearby cities and towns, using the patents of Chas. J. Rabby. B.

MASON CITY, ILL.—The directors of the various rural telephone lines, aggregating over 250 telephones that run into Easton, held a meeting to discuss plans to consolidate, incorporate and open and operate an exchange. The officers elected at the meeting were J. F. McKinley, president; C. W. Kennedy, secretary, and A. Tomlin, treasurer. It is the intention of those interested to organize a company and install an up-to-date switchboard.

TOLEDO, OHIO—The Tiffin Consolidated Telephone Company, of Tiffin, Ohio, was organized this week to take over and consolidate the interests of the Tiffin Home Telephone Company and the Central Union. The officers of the new concern are: President, Arthur A. Cunningham; vice-president, Louis Selle; secretary, A. J. Mellen; treasurer, J. J. Fleck; directors, H. W. Yeager, W. H. Kildow, J. C. Loomis, J. C. Royer, S. E. Stricklin and E. A. Reed. H.

TOLEDO, OHIO—An ordinance has been introduced into the Toledo city council to repeal the franchise of the Harrison Telephone Company granted in May, 1894. It is claimed that the concern was absorbed by the Central Union Telephone Company, and that $70,000 worth of conduits placed in the streets have been leased to the Postal company, which has been paying $7,500 annually in rentals. The claim is made that it is in violation of the terms of the ordinance, and forfeiture is asked. It was referred by the committee on public improvements to the city solicitor. H.

BRISTOL, VA.—The Cumberland Telephone Company will begin at an early date to construct a long distance line from Bristol through the coal fields of southwest Virginia. The appropriation for this work has already been made, and Manager Leland Hume announces that the new line will be ready for service not later than May next. This will give Bristol and the coal fields long distance connection with practically all the big cities of the country. The first work to be accomplished is the stringing of an additional copper wire from Knoxville to Bristol, a distance of 130 miles. This will be followed by the rebuilding of the line between Bristol and Gate City, Va., and with the construction of a line from Gate City to points in Wise and Lee counties, Virginia.

RAVIA, OKLA.—The Ravia Telephone Company has been incorporated with a capital stock of $5,000. P.

GRADY, OKLA.—The Grady Telephone Company has been incorporated by J. W. Dunford and others. P.

MART, TEX.—The Limestone Telephone Company has been incorporated, with a capital stock of $4,500. P.

ARMOUR, S. D.—The Missouri River Telephone Company was granted a franchise to maintain a toll line only. C.

ANACONDA, MONT.—The Montana Independent Telephone Company has begun installing the line to Wisdom. P.

WILLOW LAKES, S. D.—Work has been commenced on the construction of the Dakota Central telephone lines. C.

RAPID CITY, S. D.—Bids are being taken for the installation of the Black Hills Independent Telephone Company. P.

OKANOGAN, WASH.—The Okanogan Telephone and Telegraph Company has been incorporated at Okanogan by C. E. Hansen and others. A.

NAPA, CAL.—The Board of Supervisors has granted the application of Antone Rossi for a permit to erect a telephone line along the county road. A.

SYLVESTER, GA.—It is reported that T. A. Spurlin has sold the Sylvester telephone exchange to the Southern Bell Telephone and Telegraph Company. B.

MANDAN, N. D.—The North Dakota Independent Telephone Company will expend $50,000 in the construction of 214 miles of telephone lines north and south. C.

WOODSTOCK, MINN.—The Woodstock Rural Telephone Company, Geo. Moline, secretary, has been organized to construct three or four rural telephone lines. C.

BROOKINGS, S. D.—The Brookings County Telephone Company has been incorporated to take over the holdings of the Thompson, Caldwell and Wilson Telephone Company. C.

YREKA, CAL.—Permission has been granted to the T. Jones Company to erect and maintain a telephone line between the towns of Hornbrook and Walker along the public highway. A.

HELENA, MONT.—Articles of incorporation have been filed for the Deer Creek Telephone Company to operate between Grey Cliff and Big Timber. The capital of the company is $10,000.

LURAY, VA.—The Mutual Telephone Company of Luray County has absorbed the Page Valley Telephone Company, which was the first company to be organized in the Valley of Virginia.

RIVERSIDE, CAL.—The Corona Mutual Telephone and Telegraph Company has been incorporated at Corona with a capital stock of $25,000 by J. B. Golch, A. Lindberg, O. M. Grizzle and Bonfoey. A.

BOYDS, MD.—The Poolesville Telephone Company, recently organized, has sold stock to the amount of $2,500, and is completing a line to take the place of the old one which was owned by the United Telegraph and Telephone Company.

WHITEHALL, MONT.—The Montana Independent Telephone Company will shortly commence the construction of a line through to Dillon by way of Twin Bridges and the Beaverhead Valley and a branch line up the Ruby Valley to Sheridan, Ruby and Virginia City. C.

CAMBRIDGE, WIS.—The Cambridge Telephone Company has made an arrangement with the Wisconsin Telephone Company to connect with their lines and to have installed improved Bell transmitters for the local system. This agreement will greatly improve the local service. M.

OSCEOLA, IND.—A mortgage of $900 has been placed on the property and equipment of the Osceola and Dunlap Company in favor of the Indiana Union Telephone and Telegraph Company. It is the purpose of the mortgagee to extend the lines into the surrounding rural districts. S.

ELECTRICAL SECURITIES.

All of the recent happenings; the Nicaragua affair, the strike of the switchmen and the separation of the Frisco from the Rock Island system, had a bad effect on nearly all securities during the first part of the past week. Prices rose and fell in a haphazard manner. Later in the week values were supported by the more responsible buyers and rose steadily. When the street became more certain that the President's message would probably contain nothing alarming there was a renewal of interest in several industrial undertakings and a consequent upward tendency.

Application has been made to the New York Stock Exchange to list $5,974,000 first refunding mortgage five per cent bonds, due 1939, of the Washington Water Power Company.

Northwestern Elevated, Chicago, shows a daily average of passengers for November of 119,292, or 2.08 per cent increase.

The Old Colony and Boston & Northern Street Railway, Massachusetts Electric subsidiaries, have petitioned the railroad commission for approval of issue of $300,000 bonds each for funding $251,647 floating debt of the former and $266,611 of the latter.

The Atlantic & Pacific Telephone and Telegraph Company has certified to the Secretary of State of New Jersey that its entire capital stock of $250,000 had been fully paid up. The company was recently chartered with a paid capital stock of $1,000. The concern is a subsidiary company of the Bell Telephone interests.

Traffic on the Metropolitan Elevated, Chicago, during November ran about 9,000 passengers daily over that of last year, or over 150,000 passengers daily, which was the largest traffic for any month during the year. Earnings for the year are estimated at $360,000 to $375,000, or a little over four per cent on the preferred stock.

The Electric Bond and Share Company of New York has purchased, but not yet publicly offered, $1,000,000 first mortgage six per cent thirty-year sinking fund gold bonds of the Mount Whitney Power and Electric Company, of Visalia, Cal. This company was organized in November, 1909, as a successor of the Mount Whitney Power Company to operate an electric lighting and power business in Tulare County, Cal., about 250 miles from Los Angeles and San Francisco.

At the annual meeting of the North Shore Electric Company, of Chicago, Solomon A. Smith was elected a director, succeeding Charles A. Spaulding, deceased. Other directors were re-elected. The proposed increase in the capital stock was not acted upon at this time. A special meeting of stockholders will be called for that purpose. The company will make a new stock issue, probably amounting to $500,000 next spring.

DIVIDENDS.

Chicago Telephone Company; quarterly dividend of two per cent, payable December 31.

Columbus Railway and Light Company; quarterly dividend of three-fourths of one per cent, payable January 1.

Interborough Rapid Transit Company; quarterly dividend of two and one-fourth per cent upon all the capital stock, payable January 3 next to stockholders of record at the close of business December 24.

Norfolk Railway and Light Company; the usual semiannual dividend of two per cent, payable December 6.

Oklahoma Gas and Electric Company; quarterly dividend of one and one-quarter per cent upon the common stock, payable December 15 to stockholders of record as of the close of business November 30.

Portland Railway, Light and Power Company; quarterly dividend of one and one-fourth per cent, payable January 3 to stockholders of record December 12.

Washington Water Power Company; quarterly dividend of one and three-fourths per cent, payable January 3.

San Diego Consolidated Gas and Electric Company; quarterly dividend of one and onequarter per cent upon the common stock, payable December 15 to stockholders of record as of the close of business November 30.

NEW YORK.

	Dec. 6.	Nov. 29.
Allis-Chalmers common	15¾	15
Allis-Chalmers preferred	54¾	54¼
Amalgamated Copper	87⅞	86¾
American Tel. & Cable	*80	*80
American Tel. & Tel.	140¾	141¼
Brooklyn Rapid Transit	80⅞	77⅝
General Electric	159	161
Interborough-Metropolitan common	24⅝	22⅞
Interborough-Metropolitan preferred	57¾	55⅛
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	92	92
Mackay Companies (Postal Telegraph and Cables) prefd.	76½	75¾
Manhattan Elevated	139¾	138
Metropolitan Street Railway	20	21
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90¾	88¼
U. S. Steel preferred	124½	124
Western Union	77¾	78
Westinghouse common	84½	84¾
Westinghouse preferred	140	134

*Last price quoted.

BOSTON.

	Dec. 6.	Nov. 29.
American Tel. & Tel.	140¾	141¼
Edison Elec. Illuminating	249	....
General Electric	159	161
Massachusetts Electric common	15½	15¾
Massachusetts Electric preferred	76¼	78½
New England Telephone	134	134
Western Tel. & Tel. common	12⅛	12
Western Tel. & Tel. preferred	89	89

PHILADELPHIA.

	Dec. 6.	Nov. 29.
American Railways	45	45
Electric Company of America	12¼	12¼
Electric Storage Battery common	56½	58¼
Electric Storage Battery preferred	56½	58¼
Philadelphia Electric	12⅛	12⅞
Philadelphia Rapid Transit	27½	26
Philadelphia Traction	88½	89
Union Traction	53½	52

CHICAGO.

	Dec. 6.	Nov. 29.
Chicago Railways, Series 1	95	95
Chicago Railways, Series 2	31	32
Chicago Subway	5¼	5½
Chicago Telephone	135	135
Commonwealth Edison	118	118¼
Metropolitan Elevated common	16½	16½
Metropolitan Elevated preferred	51½	52
National Carbon common	97¼	96½
National Carbon preferred	120	123

PERSONAL MENTION.

JAMES CAMPBELL, for several years a director of the North American Company, was last week elected president of that concern. Mr. Campbell succeeds C. D. Wetmore who has retired on account of poor health.

A. W. BOXENDALE, manager of the Pacific Cable Company's board, is now in Montreal, Can., negotiating with the Canadian Pacific Railway Company, for the purpose of making some agreement as to carrying the cable company's business across the Dominion. The Pacific Cable Company is at present operating a service between the Pacific coast of Canada and the South Seas.

C. A. S. HOWLETT, formerly connected with the Western Electric Company of Chicago, and ex-president of the Chicago Electric Club, was in Chicago last week on a brief business trip. Mr. Howlett, who is now with the General Electric Company at Schenectady, N. Y., was a guest of the Chicago Electric Club on December 1 and was enthusiastically greeted by his old associates.

E. E. NOBLE, superintendent of construction of the Cleveland Electric Illuminating Company, Cleveland, Ohio, has invented a new pothead for use on cable terminals on poles and within stations. This pothead is made entirely of porcelain, with the exception of the contact blocks, and has been used exclusively by the Cleveland Company for over a year with very gratifying results. The appliance is being manufactured and sold by the Colonial Sign and Insulator Company, of Akron, Ohio.

H. THURSTON OWENS, consulting engineer, New York city, will deliver an illustrated lecture on "Steel Lighting Fixtures" on December 17, at 8:15 p. m. at the joint meeting of The National Commercial Gas Association and the New York Section of the Illuminating Engineering Society. Mr. Owens has investigated the public lighting in most of the large cities of both this country and Europe, and has one of the largest private collections of photographs showing street lighting conditions.

G. BREWER GRIFFIN has been appointed manager and is actively directing the sales policy of the detail and supply sales department of the Westinghouse Electric and Manufacturing Company, in which department transformers, meters, fans, heating appliances, switches, switchboards, railway line material, etc., are sold. Mr. Griffin has been assistant manager of this department for six years, having previously been connected with the sale of detail apparatus in the Boston office, altogether having been employed some seven years with this company. Previous to his connection with the Westinghouse company, Mr. Griffin was with the Manhattan General Construction Company of New York as a special representative, finally opening an office for it in Boston.

S. L. NICHOLSON has recently been appointed general sales manager of the Westinghouse Electric and Manufacturing Company, and has direct charge over the sales policies of the entire company. Mr. Nicholson has been with the company for eleven years in many different capacities, as salesman, as district department manager, and as industrial and power sales manager for the past five years, from which last position he resigned to take the present post. Before coming to the Westinghouse company he was with the C. & C. Electric Company. He is perhaps best known to motor manufacturers as the organizer and president of the American Association of Motor Manufacturers, an organization which has done much in the two short years of its life to improve the art of manufacturing motors.

PAUL M. CHAMBERLAIN has opened a consulting engineering office at 1522 Marquette Building, Chicago. Mr. Chamberlain was graduated from the Michigan Agricultural College in 1888, and from Cornell University in 1890. For several years he was engaged in practical work with the Brown Hoist Company, of Cleveland, Ohio; the Frick Company, engineers, of Waynesboro, Pa., and the Hercules Iron Works, of Aurora, Ill. He then accepted the assistant professorship of mechanical engineering at the Michigan Agricultural College. At the opening of Lewis Institute in Chicago, he took charge of the engineering work and it was largely through his efforts that it was brought up to its well-known standard of excellence. During his connection with Lewis Institute he carried on much consulting work with special reference to power production and factory methods. He resigned this position to act as chief engineer for the McCan Mechanical Works, of Los Angeles, Cal. Later he accepted the position as chief engineer of the Under-Feed Stoker Company of America, where for the past two years and a half he has made a special study of boiler-room equipment, economy in fuel burning and smoke abatement. He will devote his time to new designs and improvement of existing installations.

OBITUARY.

A. E. DRESSER, manager of the Fort Wayne Electric Works' Syracuse office, died on Sunday, November 28, of heart disease and was buried at Ithaca, N. Y., November 30. He was forty-six years of age and had been in the employ of the Fort Wayne electric Works as manager of its Syracuse office for ten years, prior to which he was with the Fort Wayne Electric Corporation and formerly connected with the General Electric and Thomas-Houston companies. Mr. Dresser had a wide circle of friends in the electrical trade in central and western New York, where he always resided.

NEW PUBLICATIONS.

INTERNATIONAL BUREAU OF THE AMERICAN REPUBLICS—The November, 1909, Bulletin, which has just been issued contains almost a plethora of interesting and valuable news of the South American republics, and is recommended to the attention of all who are interested in a business way with our southern neighbors. The most noteworthy article, from an engineering standpoint, is "Opening up Oriente (Cuba)," by I. A. Wright, editor of the Cuba Magazine, Camaguey, Cuba, W. I.

TECHNOGRAPH—The 1908-1909 (No. 23) number of "Technograph," the annual publication of the engineering societies of the University of Illinois, which has just been issued, contains some interesting articles. Among these may be mentioned "The Illinois Engineering Experiment Station," by L. P. Breckenridge; "Steam Turbine Performance" (abstract of a paper read before the Western Society of Engineers, May 5, 1908), by J. C. Thorpe, and "Test of a Three-Kilowatt Westinghouse Type S. Transformer," by Antonio Guell and Hubert M. Turner.

THE GENERATOR, NEW YORK ELECTRICAL SCHOOL—The students of the New York Electrical School have published the November number of *The Generator*, in which there is an excellent article on "Phototelegraphy and the Korn Phototelegraph." There are also contained a large number of interesting notes which show that this little monthly is being excellently handled by the enterprising students of the school. This is only the third number of the publication, but represents considerable progress and speaks well of its fuure.

TUNGSTEN STREET SERIES LAMPS—The Engineering Department of the National Electric Lamp Association has just issued Bulletin No. 6-G entitled, "Tungsten Street Series Lamps." This publication supersedes Bulletin 6-A, and contains much additional information in regard to this very popular type of lamp for incandescent street lighting. These lamps operate quite well on direct current or alternating current circuits. In the latter instance they are used quite commonly with as low as twenty-five cycles without perceptible flicker. The life rating that is placed on these lamps is 1,350 hours, which is known to be a very conservative figure, as in most instances this is very much exceeded. The bulletin gives distribution and other performance curves, complete data of every characteristic of the lamps, and comparisons of tungsten and carbon lamps for this service.

PROPOSALS.

POST OFFICE, LIMA, OHIO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 10, 1910, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Lima, Ohio, in accordance with drawings and specifications, copies of which may be obtained at this office or from the custodian at Lima, Ohio, or at the Supervising Architect's office.

POST OFFICE, ATHENS, OHIO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 28, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Athens, Ohio, in accordance with the drawings and specification, copies of which may be had from the custodian of site at Athens, Ohio, or at the Supervising Architect's office.

POST OFFICE, BEATRICE, NEB.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 29 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and tower clock) of an extension, remodeling, etc., to the United States Post Office at Beatrice, Neb., in accordance with drawings and specification, copies of which may be obtained from the custodian at Beatrice, Neb., or at the Supervising Architect's office.

POST OFFICE, CHESTER, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 11, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Chester, Pa., in accordance with the drawings and specifications, copies of which may be had from the custodian at Chester, Pa., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, BRISTOL, TENN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 12, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office and Court House at Bristol, Tenn., in accordance with drawings and specifications, copies of which may be had from the custodian at Bristol, Tell., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., is to furnish the Palmilla Milling Company, of Parral, Mex., with twenty-two Allis-Chalmers motors to be used in their new gold reduction plant. The motors will drive stamps and accessory machinery of the latest type, all of which is to be furnished by the Allis-Chalmers Company.

THE CHARLES L. KIEWERT COMPANY, of Milwaukee, New York, and San Francisco, is distributing a circular on Siemens E carbons for direct-current and alternating-current enclosed arc lamps. Among advantages of these carbons there are pointed out their long life, high efficiency, straightness and uniformity and brilliant white light produced.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, O., is circulating a striking folder with the title, "Ask the Chairman." This shows that the invariable rule of the chairman of any well-established board of directors is to buy of a manufacturer who has a reputation to live up to, and it further makes clear that the Buckeye reputation is one of this order.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has just distributed the December "Bargain Sheet" which contains revised and reduced prices on electrical machinery and equipment. In connection with this list, the company is also distributing circulars devoted to descriptions of Century single-phase motors, for which it is the sales agent, and of new National direct-current motors.

THE WIRE AND TELEPHONE COMPANY OF AMERICA, with headquarters at Rome, N. Y., announces that on and after December 14 it will change its corporate name to the ROME WIRE COMPANY. There will be no change in the management or policies of the company, however, and it will continue to manufacture the wellknown "Romeoid" bare and insulated wires for electrical purposes.

THE CENTRAL ELECTRIC COMPANY, of Chicago, Ill., is distributing two new circulars descriptive of D. & W. service switches, fuses and cutouts. These bulletins will be found of considerable value to central-station managers in that they give information on several new devices for use on highly inductive circuits such as offered by power loads. Copies of these circulars will be sent upon request.

THE HOLOPHANE COMPANY, of Newark, O., is sending out an interesting folder entitled, "Who's to Blame?" It shows clearly that seventy-five per cent of the errors that occur in any plant happen after dark, and it points out that the trouble in most instances is caused by very poor light. It also offers to send out a copy of its booklet "The Lighting of Mills and Factory" to those interested in the subject of effective and efficient factory lighting.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing the new price list and discount sheet to be used in connection with catalogue No. 26. The final pages of this publication contain descriptions and illustrations of new apparatus and supplies which have been brought out since the last catalogue was issued. The last page is devoted to electrical devices for domestic purposes and offers suggestions for the holiday trade.

THE HOYT ELECTRICAL INSTRUMENT WORKS, of Penacook, N. H., is distributing Bulletin No. 2, which deals with type 35 Hoyt voltmeters and ammeters. The type IU volt-ammeters are also described. The instruments are especially designed for direct current service and are made both for switchboard and for portable use. The volt-ammeters consist of two type C-35 instruments, one a voltmeter and the other an ammeter, and are particularly suitable for mounting on electric vehicles.

THE FEDERAL ELECTRIC COMPANY, Lake and Desplaines streets, Chicago, which is well known for its manufacture of electric signs and electric lighting specialties, has developed a new line, namely, that of the manufacture of vacuum cleaners. A sixteen-page booklet has just been published by the company relative to the many uses and marked advantages of this machine. The pamphlet is illustrated by many excellent engravings which give a very good idea of the ease of manipulation and the variety of purposes for which the Federal vacuum cleaner is adapted.

THE COLONIAL SIGN & INSULATOR COMPANY, of Akron, Ohio, well-known maker of porcelain electric sign letters and other porcelain electric specialties, is manufacturing a new line of all-porcelain potheads for distribution network cables. These potheads have been tested out under severe service and test conditions for more than a year and have given excellent results. They are weatherproof, compact and light but rugged in construction. Beside standard sizes the company can make them for special conditions and will furnish full information and illustrations of numerous applications upon request.

THE AMERICAN PLATINUM WORKS, of 251-255 New Jersey Railroad Avenue, Newark, N J., have acquired by purchase the real estate and building formerly owned and occupied by the Caffrey Leather Company and J. Liebstein & Sons, located at 225-227-229 and 231 New Jersey Railroad Avenue (Newark), covering half a block on that avenue—110 feet—and having a frontage of 250 feet on Oliver and thirty feet on Chestnut streets. The present buildings will be reconstructed and modernized and additional structures will be erected, which, when finished will give this company one of the most complete plants in the world for the refining of platinum, gold and silver.

THE MOORE ELECTRICAL COMPANY, 169 Malvern Street, Newark, N. J., has just published Bulletin No. 22 dealing with the Moore light. The Moore light is now made in two types, the white Moore tube and the yellow Moore tube. In the former system rarified carbon dioxide is used in the tube, and in the latter nitrogen is used instead. These tubes are operated on sixty-cycle alternating current systems. The white tubes have been found to yield a very close approach to daylight, and therefore are serviceable in many mercantile shops where color matching is an important feature. The yellow tubes are somewhat more efficient and are advocated for the illumination of large areas.

PASS & SEYMOUR, INC., of Solvay, N. Y., have issued their new catalogue No. 18 which is devoted to the large number of specialties manufactured by this old and well-known firm. This catalogue contains 144 pages, giving an excellent idea of the great variety of the products manufactured. It is prepared in a very convenient form, however, so as to be easily slipped in the pocket of electrical contractors or wiremen who have occasion to use the P. & S. specialties very extensively. Accompanying the catalogue is a price list and discount sheet Number 180, which alone contains forty pages. Copies of these publications will be supplied to those interested in electrical wiring supplies.

JAMES BEGGS & COMPANY, 109 Liberty Street, New York city, are distributing a new and greatly enlarged edition of "Feed Water Filtration." This book explains how oil, dirt, etc., get into feed water, what damage they do within the boilers, and how to remove such impurities before this can occur. It tells how water of condensation and returns from heating systems may safely be used to cut down the coal and water bills and it explains the advantages and disadvantages of various methods of filtration. Numerous instances are cited where filtration through terry cloth at the last point in the line before water enters the boilers has proven successful after other methods have failed. The Blackburn-Smith feed-water filter and grease extractor is described in detail. Engineers will find this book well worth writing for.

THE MONARCH TELEPHONE MANUFACTURING COMPANY, Washington and Morgan Streets, Chicago, Ill., has recently issued a booklet entitled "A New Source of Revenue for Telephone Exchanges." This little publication describes quite fully the operation and possibilities of the company's system of electric clocks and electric time stamps. It brings to light the fact that these are yet undeveloped sources of revenue in even the moderate sized telephone plant and sets forth the convenience of a system of electric clocks operated by a master clock at the central station. One of the most interesting pieces of information is a set of tables containing estimates of the expense of installation of clock systems under several conditions. The deduction from the tables is that a telephone company can develop the time-service business and make a profit from two to three times as great as that secured from telephone subscribers.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., is distributing three bulletins known as Nos. 116, 117 and 118 respectively. Bulletin No. 116 is devoted to motor-generator sets, which are important factors in the distribution of electrical energy on the modern power system. No power station could be profitably equipped with the assortment of machinery which would be necessary to supply electric current to meet the varied requirements of a modern power system. The current produced by the central power station must be adapted to the service of the greatest number. In order to supply the needs of the minority, transforming devices of some sort must be used. The functions of the motor-generator set and the methods of choosing the motor-generator best adapted for each condition have been clearly outlined in this bulletin. Bulletin No. 117 describes Form L, direct current machines. Small direct current motors have proved their value in every modern industry and are used for a variety of applications, from running lathes to operating organ blowers. The application of these motors to laundry apparatus, printing presses and other machinery with similar requirements, has brought about changes and improvements in the respective industries which are having an important effect on their development. For this reason this bulletin, describing apparatus of this type, has a decided interest for every manufacturer. It is well illustrated with halftone engravings, showing applications of Crocker-Wheeler motors to various types of machinery. "Motor Drive in the Laundry" is the title of Bulletin No. 118. The application of electric motor drive to laundry machinery has brought about greater cleanliness, better light, saving in power, increased output, saving in repairs, greater comfort to employees and greater flexibility of location of machines. All these items have such a direct bearing on the effectiveness and efficiency of any equipment that no laundryman can afford to ignore them. How motor drive has gained these results for the laundries is clearly outlined in this pamphlet.

THE McROY CLAY WORKS, Brazil, Ind., manufacturers of conduits for telephone, telegraph, electric light and power cables, is distributing a blotter containing a calendar for the month of December and a convincing illustration of a demonstration of the strength of McRoy conduits.

T. J. COPE, 3244 North Fifteenth Street, Philadelphia, Pa., reports his business as better than it has ever been before in his twenty-four years' experience. Though general business conditions have not been good for the past two years his business has increased to such an extent that he now has five different shops at work turning out his underground electrical specialties.

THE ENTERPRISE MACHINE MANUFACTURING COMPANY, 2625 Sarah Street, Pittsburg, Pa., has placed a new line of pneumatic and water-driven boiler-tube cleaning outfits on the market at an extremely low price. While the company is selling these outfits at little more than half their former price, there has been no decrease in excellence of quality, the drop being due to improved methods of manufacture.

THE ALLIS-CHALMERS COMPANY is supplying the equipment for a municipal lighting plant for the city of Greenville, Texas. It will consist of two 300-kilowatt, sixty-cycle, three-phase alternators, direct-connected to fourteen and thirty by thirty-six cross-compound engines, running 120 revolutions per minute, and will include condensers. There will be one engine and one induction motor-driven exciter, also the necessary switchboard panels.

THE MECHANICAL APPLIANCE COMPANY, Milwaukee, Wis., has published a new bulletin describing its type "K" polyphase induction motors. This pamphlet gives full details of construction of the stator and rotor, as well as of the frame, bearings and shaft. The operating characteristics of these motors are discussed, and the care in inspection and testing that they receive before shipment is made clear. A few of the manifold applications of the motors are briefly described.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a unique price list of the well known Columbia carbon lamps of various types. This price list contains revised prices and should be in the possession of every lamp user. An improved method of indexing enables the user to immediately find the price on any desired line. This company is also distributing a new folder descriptive of a combined electric stove and toaster which is a decidedly new type. This is a universal device provided with a toasting drawer and a heating plate so that you can prepare your coffee and toast at the same time.

THE NERNST LAMP COMPANY, Pittsburg, Pa., has recently distributed an attractive booklet devoted to factory lighting. Since the Nernst lamp was first introduced in 1901 many improvements have been made, among which may be mentioned the wafer heater; the spring type holder for multiple glower lamps and the screw burner for single glower lamps which have simplified the system greatly and made the Nernst lamp particularly suitable for factory lighting. This book contains many photographs of factories in which Westinghouse Nernst lamps have been installed and also many expressions from factory men in favor of this lamp.

THE BUCKEYE ELECTRIC COMPANY, Chicago, Ill., announces that F. E. Whorff, chief electrician of the San Francisco Harbor Commission, has an interesting record on the lighting of the Ferry building. About the first of the year, Buckeye tungsten incandescents were substituted for the carbon filament and arc lamps in use in the waiting rooms and nave of the building. The lighting was improved 100 per cent and according to the records that have been kept the consumption of electricity has been cut about forty per cent. Ten clusters of six 100-watt lamps each, were installed in the nave and the records show that these lamps have given a continuous service of over 2,750 hours, to date. There has been no appreciable loss of candle power. Four lamps were carefully examined recently and showed no evidence of deterioration and when tested with a watt-meter, showed less than the rated consumption in each case. The readings were: 91.0, 92.5, 92.5 and 97.5 watts, respectively, for the four lamps. Renewals since the first of the year have been two in number.

DATES AHEAD.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

San Francisco Electrical Exposition, January 29, February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Wachtung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

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AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

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ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

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ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, H. F. Frase, Edison Electric Illuminating Company, Brook-

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ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Perry-Payne Building, Cleveland, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Ploda, Oak and Broderick Streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Confederation Life Building, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 157 Bay Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 627 Jackson Boulevard, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 25 West Forty-second Street, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK. (Member National Electrical Trades Association.) Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West Thirty-ninth Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allan J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary and treasurer, A. P. Biggs, Detroit, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, O.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, F. M. Tait, 124 East Fourth Street, Dayton, Ohio. Executive secretary, T. C. Martin, 33 West Thirty-ninth Street, New York city.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State Street, Boston, Mass.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, Roy M. Van Vliet, Monadnock Block, Chicago, Ill.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, 96 Franklin Street, South Framingham, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe Street, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 30, 1909.

941,354. INDICATOR. Alfred J. Border, Wellington, New Zealand, assignor of one-half to Lucy Maude Coventry, Wellington, New Zealand. Filed May 10, 1906. A drum can be intermittently rotated in either direction by the action of two solenoids.

941,362. SYSTEM OF ELECTRICAL DISTRIBUTION. Richard J. Dearborn, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 3, 1906. The system includes a rotary converter and a storage battery connected to a polyphase alternating-current circuit. A motor-driven voltage regulator varies the ratio of transformation, and the motor works forward or reverse according as the mean current variations in the circuit are above or below a predetermined amount.

941,363. TROLLEY-CATCHER. Charles I. Earll, New York, N. Y. Filed September 30, 1903. Automatic means for checking the rotation of the trolley-rope drum may manually be made inoperative.

941,366. PRIMARY BATTERY. Charles E. Hite, Burlington, N. J. Filed April 15, 1907. A multichambered primary-battery cell is lined with hard rubber, and a removable lid for the same carries, on its under side, springs provided with aluminum terminals.

941,372. SYSTEM OF ELECTRICAL DISTRIBUTION. Paul M. Lincoln, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 3, 1906. Similar to No. 941,362, but includes a booster and has different regulation features.

941,388. CROSS CONNECTIONS FOR DYNAMO-ELECTRIC MACHINES. Robert Siegfried, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 3, 1905. Cross connections for radially adjustable brush-holder brackets comprise conducting ring segments having end slots.

941,390. UNDERRUNNING CURRENT-COLLECTOR. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed November 23, 1904. An underrunning contact shoe is supported by a spring-controlled parallelogram device.

941,391. ELECTRIC CAR-CONTROLLING SYSTEM. Arthur B. Stitzer, Philadelphia, Pa. Continuation of application. Filed April 30, 1909. This application filed August 2, 1909. Describes the motor and controller connections for an electric-railway system.

941,397. MOTOR-CONTROL SYSTEM. Harold E. White, Schenectady, N. Y., assignor to General Electric Company. Filed June 23, 1909. The voltage applied to the motor in starting, is increased step by step by contactors operating in succession. The operating coil of the first contactor is at first connected in shunt to the motor, and auxiliary switches, co-operating with the contactors, are provided each to operate a succeeding contactor.

941,408. CONTROL OF ELECTRICALLY-OPERATED SWITCHES. Archibald S. Cubitt, Schenectady, N. Y., assignor to General Electric Company. Filed May 7, 1908. Means controlled by current through any of the several actuating circuits, which are connected successively to successive switches, are provided for temporarily interrupting the succeeding actuating circuit; also means controlled by the several switches for connecting the succeeding switch to its actuating circuit.

941,412. MOTOR-STARTER. Max R. Hanna, Schenectady, N. Y., assignor to General Electric Company. Filed September 12, 1907. The first of a number of switches for operation in succession to increase step by step the voltage applied to the motor, is provided with means for rendering it responsive to the counter electromotive force of the motor. The last switch is made responsive to the current in the motor circuit.

941,416. PRIMARY ELECTRIC CELL OR BATTERY. Albrecht Heil, Frankfort-on-the-Main, Germany. Filed April 6, 1909. A depolarizer is used, consisting of sulphate of mercury, finely divided carbon, and free mercuric oxide.

941,419. ELECTRIC FURNACE. Charles A. Keller, Paris, France. Filed November 4, 1908. The hearth consists of a metal plate with projections therefrom, and constitutes one of the electrodes.

941,425. ELECTRIC-CIRCUIT CONTROLLER. Harry W. Leonard, Bronxville, N. Y. Original application filed November 30, 1901. Divided and this application filed April 6, 1906. Resistance may be automatically inserted in the motor-starting rheostat independently of the movement of the circuit breaker.

941,432. ELECTROPNEUMATIC PIANO-PLAYER. Arthur R. Trist, St. Albans, England, assignor to Trist Piano-Player, Limited, London, England. Filed November 10, 1906. The pneumatic note-actuating mechanism is operated when the electric circuit of the electric control device (fitted to each orifice on the tracker) is completed by the perforated music record.

941,435. INDUCTION-FURNACE. Magnus Unger, Pittsfield, Mass., assignor to General Electric Company. Filed May 6, 1908. A number of magnetic cores are provided with independent primary windings, in inductive relation with which are narrow segmental annular chambers opening into the central treating chamber.

941,436. ELECTRIC METER. Frederick M. Vogel, Lynn., Mass., assignor to General Electric Company. Filed September 14, 1904. A meter for alternating currents has a rotatable conducting member threaded by two magnetic circuits, one of which circuits is energized by a series winding assisted by a potential winding, the other current being energized by a series winding arranged to oppose a potential winding. Short-circuited conductors are disposed adjacent to the rotatable member and oppositely displaced from the axis of the magnetic circuits.

941,439. MOTOR-GENERATOR SET. Wilmot A. Danielson, Des Moines, Iowa, assignor to General Electric Company. Filed August 18, 1908. The motor has a field winding in series with the load circuit, and the generator a field winding in shunt to the motor armature.

941,441. RHEOSTAT. George H. Dorgeloh, Schenectady, N. Y., assignor to General Electric Company. Filed June 10, 1908. An unbiased controlling arm for the starting resistance controls an automatic circuit-breaker, the latter being also controlled by a latch which holds closed a switch which is provided in connection with the arm for short-circuiting the same when it reaches running position.

941,445. ALUMINUM CELL REACTANCE. John J. Frank, Pittsfield, Mass., assignor to General Electric Company. Filed February 2, 1909. Each of a number of aluminum condenser

cells is connected to the secondary winding of its respective one of a number of transformers, the primary windings of which are connected in parallel by a separate circuit. The electrodes of adjacent cells are electrically connected, the end electrodes being connected respectively to the line wires.

941,456. DYNAMO-ELECTRIC MACHINE. Fred B. Howell, Schenectady, N. Y., assignor to General Electric Company. Filed August 30, 1907. A dynamo field-coil support has a crown-shaped portion, and a flanged portion with upturned edges.

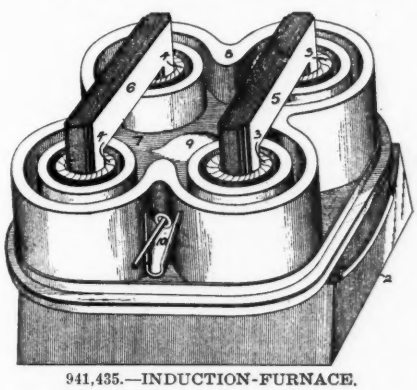
941,459. ELECTRIC METER. Peter C. Morganthaler, Fort Wayne, Ind., assignor to Fort Wayne Electric Works. Filed May 22, 1909. An alternating current meter has a U-shaped core with double poles, a potential pole carried thereby, a series coil surrounding the inner poles of the core, and lagging coils surrounding the outer poles of the core.

941,467. ALTERNATING-CURRENT APPARATUS. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed November 23, 1905. Describes a wattmeter for alternating current.

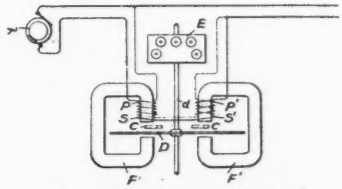
941,468. ELECTRIC METER. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed March 19, 1906. Similar to the preceding.

941,469. ALTERNATING-CURRENT METER. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed March 21, 1906. Two independent inductors act indirectly on a secondary element common to both of them, and means are provided for eliminating torque produced by the mutual reactive effects of the inductors and for establishing opposing torques.

941,519. INTERMEDIATE TELEPHONE-CONNECTOR. Charles A. Hearn and William H. Feddeohann, Decatur, Ind. Filed August 27, 1908. An arm projecting from a pole is provided with telephonic connections as for establishing temporary telephonic connection with a railroad car.



941,435.—INDUCTION-FURNACE.



941,436.—ELECTRIC METER.

941,534. ELECTRIC-SWITCH HANDLE. Johann G. Peterson, Hartford, Conn., assignor to The Arrow Electric Company, Hartford, Conn. Filed June 15, 1909. A headed spring-retracted stem is movable in the socket of a body of insulating material and is held in position by a suitable yoke.

941,535. ELECTROPLATING APPARATUS. Louis Potthoff, Flushing, N. Y. Filed February 2, 1909. The articles to be plated are placed in a movable tumbler, and automatic progressive means are provided for subsequent washing, etc.

941,541. CAB-SIGNAL CIRCUIT. Paul J. Simmen, Los Angeles, Cal. Original application filed June 19, 1908. Divided and this application filed December 15, 1908. Describes an electric signal system connecting a vehicle cab with a circuit arranged parallel with the trackway.

941,556. SPARK-TIMER FOR INTERNAL-COMBUSTION GAS-ENGINES. Omar L. Brainard, Sacramento, Cal. Filed January 20, 1909. An internal gear is provided with a number of insulated segments.

941,585. METHOD OF PRODUCING INSULATING BODIES. Valentin A. Noodt, Hamburg, and Georg Göttsche, Altona, Germany; said Göttsche assignor to said Noodt. Filed March 19, 1908. Foliated charcoal is added to a liquid binding medium in quantity sufficient to take up the liquid, whereupon the mass is stirred until the charcoal assumes a splinter formation, after which the mass is compressed to form a porous body.

941,593. INCANDESCENT LAMP. Ross D. Tiffany, Bellingham, Wash. Filed August 27, 1908. An electric incandescent lamp has a number of separate filaments and a switch mechanism for including these, as required, in the circuit.

941,599. MEANS FOR RECTIFYING SINGLE-PHASE CURRENTS. Joseph L. Woodbridge, Philadelphia, Pa. Filed May 4, 1908. A dynamo-electric machine, to the rotatable armature of which is supplied alternating current, has its armature mechanically connected to a synchronous motor electrically connected to the circuit.

941,600. SYSTEM OF ELECTRICAL DISTRIBUTION. Joseph L. Woodbridge, Philadelphia, Pa. Filed May 18, 1908. Uses a combination of storage batteries and dynamo-electric machine, etc.

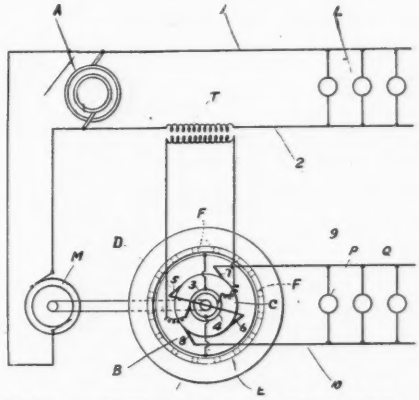
941,660. ELECTRIC SWITCH. Frank W. Smith, New York, N. Y. Filed February 25, 1909. A link pivoted at one end to a pivoted circuit-closing switch arm is electromagnetically moved along a fixed guide bar.

941,666. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed December 19, 1902. Describes in detail a telephone system for a central office and substations.

941,673. ELECTROVIBRATORY COUCH. Walter A. Church, Los Angeles, Cal., assignor to Electro-Vibrating Couch Company, Los Angeles, Cal. Filed December 21, 1908. A vibrating crank is operated by an electric motor.

941,690. ELECTRICAL SYSTEM OF DISTRIBUTION. Walter E. Winship, New York, N. Y., assignor to Gould Storage Battery Company. Filed March 11, 1905. A converter is operatively connected between an alternating-current circuit and a direct-current circuit, the latter circuit having a battery operatively arranged in respect to it. This battery is caused to charge and discharge and operatively arranged to respond to variations of load on either circuit.

941,709. RELAY. Thomas W. Gleeson, Boston, Mass. Filed January 29, 1908. An armature having a pair of similar and constant magnetic poles movable in unison, is devised so that each pole will co-operate with one of two opposite poles of the electromagnet of the relay.



941,599.—MEANS FOR RECTIFYING SINGLE-PHASE CURRENTS.

941,720. LINING FOR STORAGE-BATTERY JARS. Albert J. Meier, Glendale, Mo. Filed November 6, 1908. A lead lining for storage-battery jars has longitudinal ribs on the side walls, etc.

941,743. TELEPHONE-LINE SELECTIVE SWITCH DEVICE. John H. Swanson, Baldwin, Wis., assignor of one-fourth to T. F. Robinson, St. Paul, Minn. Filed February 21, 1907. Describes a form of polarized relay.

941,761. RELAY. Elmer R. Corwin and Charles A. Bals, Chicago, Ill., assignors to Corwin Telephone Manufacturing Company, Chicago, Ill. Filed September 21, 1908. A relay comprising a coil, return magnetizable bar, armature, switching mechanism to be operated by the armature, etc., is devised so that the coil with its spool may be removed without dismounting the bar and switching mechanism.

941,762. DESK-TELEPHONE. Elmer R. Corwin and Charles A. Bals, Chicago, Ill., assignors to Corwin Telephone Manufacturing Company, Chicago, Ill. Filed December 26, 1908. Has certain takedown features.

941,763. BANK OF LOCKING SWITCH-KEYS. Elmer R. Corwin and Charles A. Bals, Chicago, Ill., assignors to Corwin Telephone Manufacturing Company, Chicago, Ill. Filed January 29, 1909. A distributing strip having terminals thereon is carried by the framework whereby conductors leading from the series of push-button switches may be connected with external conductors leading to the bank of keys.

941,768. ELECTRIC FURNACE FOR GAS REACTIONS. Otto Dieffenbach and Wilhelm Moldenhauer, Darmstadt, Germany. Filed August 25, 1908. One of the two electrodes is composed of a charge of fragments of carbon through the interstices between which the gas is supplied.

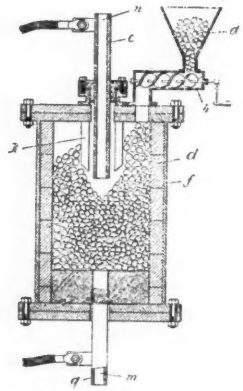
941,777. MEANS FOR CONTROLLING ELECTRIC CIRCUITS. Gerald W. Hart, West Hartford, Conn., assignor to The Hart Manufacturing Company, Hartford, Conn. Filed April 5, 1909. The circuit connections for a translating device, a local circuit for an electromagnetic device in shunt to the other device, etc., are controlled by two three-point switches.

941,796. ANODE-MOLD. John F. Miller, Trail, British Columbia, Canada, assignor of one-half to Walter H. Aldridge, Trail, British Columbia, Canada. Filed November 10, 1906. A drawing member having positive engagement with the molten metal in the mold is provided for withdrawing the cast metal.

941,811. KEYLESS SOCKET. Clarence D. Platt, Bridgeport, Conn. Filed October 22, 1908. One of the ends of an insulating body has side recesses extending to the end surface, and an internal recess extends from the other end of the body to one of the side recesses.

941,824. INDICATING COIN-HOLDER FOR TELEPHONE-USERS. Elijah F. Stone, Chicago, Ill. Filed January 14, 1909. Each of a series of token-holder recesses in a vertical support is adapted to hold a single coin or token by its edge in a horizontal position so that the coins or tokens may be withdrawn separately without affecting the others. An associated index has consecutive numerals for each recess, together with the corresponding days of the week.

941,826. THERMO-ELECTRIC GENERATION. John D. Taylor, Pittsburg, Pa. Filed March 27, 1907. Renewed January 18, 1909. The current is periodically reversed through each thermo-junction.



941,768.—ELECTRIC FURNACE FOR GAS REACTIONS.

941,839. TELEPHONE-EXCHANGE SYSTEM. Charles L. Zahm, Los Angeles, Cal., assignor of one-fourth to Edward E. Clement, Washington, D. C. Filed September 19, 1905. Describes an automatic telephone system.

941,859. TERMINAL FOR ELECTRIC CABLES. Charles W. Davis, Edgeworth, Pa., assignor to Standard Underground Cable Company, Pittsburg, Pa. Filed August 3, 1908. A lead-out is adapted to be secured to a conducting core of the cable and extending through an annular insulator. The lead-out and insulator may be locked together after the former has been secured to the conductor of the cable.

941,860. TERMINAL FOR ELECTRICAL CABLES. Charles W. Davis, Edgeworth, Pa. Filed March 6, 1909. Describes a terminal structure for a multiple-core cable.

941,863. ADJUSTABLE SUPPORT FOR ELECTRIC LAMPS. Leonard Erikson, Malden, Mass. Filed January 16, 1909. The angle of inclination of the lamp may be adjusted by means of a kind of ball-and-socket joint located at the upper end of an adjustable standard.

941,891. SYNCHRONIZING APPARATUS. Pietro Pierini, Rome, Italy. Filed May 16, 1908. Describes an electric device for synchronizing the operation of a cinematograph and a talking machine.

941,904. PROCESS FOR TREATING CERTAIN ORES. Herbert S. Auerbach, New York, N. Y. Filed September 6, 1906. The ore to be treated is supplied to a fused body of metal which is capable of taking it into solution; an electrolyte is formed above the metal and out of contact with the ore, and the ore is connected as the cathode of an electric furnace and is reduced by the passage of an electric current through the metal and through the electrolyte.

941,938. TELPHERAGE SYSTEM. Herman Müller, Leipzig, Germany. Filed February. 7, 1906. Describes a circuit-closing arrangement for telpher cars.

941,941. SWITCH FOR INCANDESCENT-LAMP SOCKETS. Will A. McDonald, Grampian, Pa. Filed February 26, 1909. A pair of levers pivotally mounted in a stationary frame at right angles to each other are provided with handles on their projecting ends. One of these levers constitutes a contact member and is arranged to be locked in its operative position by a movement of the other lever.

941,944. TROLLEY-RETRIEVER. Charles Palm, Aurora, Ill. Filed September 22, 1908. A rotatable drum is engaged by a rotary clutch.

941,979. ATTACHMENT FOR ELECTRIC APPLIANCES. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr., San Francisco, Cal. Filed August 7, 1908. A ring or eyelet is secured at the point where the individual conductors of a turn conductor diverge or separate from the twin. There is a retaining band in the rear of the ring and the ring is secured in place by the individual conductors.

941,996. PROCESS OF SEALING FILAMENT-CARRIERS INTO BULBS OF ELECTRIC INCANDESCENT LAMPS. Johann Kremenezky, Vienna, Austria-Hungary. Filed September 17, 1908. The (originally cylindrical) neck of the vertically disposed bulb blank is caused by a blowpipe flame to contract and fuse on to a disk which forms the bottom of the filament carrier, the lower portion of the neck separating and falling away by virtue of its own weight.

942,002. WALL CABINET FOR ELECTRICAL APPARATUS. Ernest R. Le Manquais, Bellemead, N. J., assignor to Le Manquais Electrical Manufacturing Company, Bellemead, N. J. Filed May 11, 1907. The side portion of the box is partly formed of a number of independently removable sections, etc.

942,044. WIRELESS TELEPHONY AND TELEGRAPHY. Alexander W. Sharman, Clapham, London, England. Filed July 16, 1909. A telephonic transmitter is placed in circuit with a self-induction coil (grounded at each end) and a source of low-tension current; a telegraphic interrupter is adapted to be placed in the same circuit, and a signal key is provided to break suddenly the circuit through the coil.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 6, 1909:

487,242. ELECTRIC MOTOR. Franklin H. Beers, Newark, N. J.

487,285. ELECTRICAL HEATER. Willis Mitchell, Malden, Mass.

487,302. METHOD OF ELECTRIC WELDING. Elihu Thomson, Swampscott, Mass.

487,307. CONNECTION FOR COMMUTATORS AND ARMATURE WIRES. Ernest P. Warner, Chicago, Ill.

487,315. ELECTRIC ARC LAMP. Jas. J. Wood, Fort Wayne, Ind.

487,324. GALVANIC BATTERY. Jas. I. Gethins, Boston, Mass.

487,329. ELECTRIC MOTOR FOR CARS. Chas. A. Jackson, Reading, Mass.

487,332. CLAMP FOR ELECTRIC CONDUCTORS. Henry Lindahl, Chicago, Ill.

487,356. APPARATUS FOR DISTRIBUTION OF ELECTRICITY. Thomas Tomlinson, London, England.

487,360. INCANDESCENT ELECTRIC LAMP. Eugene W. Applegate, Omaha, Neb.

487,437. ELECTRIC BELL. Peter Wagner, New York, N. Y.

487,457. SWITCH OPERATING DEVICE. John D. Stone, Syracuse, N. Y.

487,461. ELECTRICAL DEVICE FOR PREVENTING CRIBBING IN HORSES. Geo. W. Whitefield, Evanston, Ill.

487,462. CONNECTION-PLATE FOR DYNAMOS. Jas. J. Wood, Fort Wayne, Ind.

487,477. INCANDESCENT ELECTRIC LAMP. Gustav A. Frei, Springfield, Mass.

487,479. INCANDESCENT ELECTRIC LAMP. Gustav A. Frei, Springfield, Mass.

487,543. SYSTEM OF ELECTRICAL DISTRIBUTION. Oliver B. Shallenberger, Rochester, N. Y.

487,584. MOTOR. Benjamin S. Partridge, Jacksonville, Fla.

487,607. METHOD OF ARC AND INCANDESCENT METAL HEATING. Chas. L. Coffin, Detroit, Mich.

487,644. PROCESS OF AND APPARATUS FOR GENERATING ELECTRICITY. J. S. Rogers, New York, N. Y.

487,654. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Albion A. Vanderpool, Newark, N. J.

487,655. ELECTRO-THERAPEUTIC PROCESS AND APPARATUS. Joshua M. Wardell, Cadillac, Mich.

487,676. ELECTRIC SIGNALING APPARATUS. Morris Martin, Malden, Mass.